November 10, 2023

Robert Lilbourne
Director of Community Services
Municipality of Strathroy-Caradoc
52 Frank Street
Strathroy, Ontario N7G 1T8

Re: **LON-23011333-A0** **Limited Indoor Air Quality Assessment – Volatile Organic Compounds Various Fire Stations – Municipality of Strathroy-Caradoc**

Dear: Mr. Lilbourne

Version Control

Version	Date	Revised Description	Submitted by	Reviewed by
1.0	October 13, 2023	Initial Draft	Ali Ismail	Keith Hill, Ali Ismail
1.1	November 8, 2023	Additional information to Section 4 (Sampling Method) on difference between area and personal air sampling.	Ali Ismail	Keith Hill, Ali Ismail
2.0	November 10, 2023	Additional information to Section 5.2 (Exposure Values and Guidelines) on trigger level and action level. Final Version	Ali Ismail	Keith Hill, Ali Ismail

1 Background and Scope of Work

EXP Services Inc., (EXP) was retained by the Municipality of Strathroy-Caradoc to conduct a limited indoor air quality assessment within the administration and apparatus bay areas (project areas) of three (3) fire stations located in the Municipality of Strathroy-Caradoc. The assessment was completed to evaluate the presence of volatile organic compounds (VOCs) within the project area of each of the following fire stations:

- Station #1 – 23 Zimmerman Street, Strathroy, ON

- Station #2 – 688 Bowan Street, Mount Brydges, ON
- Station #3 – 21912 Melbourne Road, Melbourne, ON

This assessment consisted of the collection of six (6) area air samples and one (1) field blank from within the project areas.

EXP completed the assessment of the project areas on September 25, 2023.

2 Facility Details

The project areas included the administration areas and apparatus bays within the three (3) fire stations located in Strathroy, Mount Brydges and Melbourne, within the Municipality of Strathroy-Caradoc.

Apparatus bays are where firefighting and emergency response vehicles/equipment are generally stored. General maintenance work activities such as vehicle washing, equipment decontamination and cleaning often occur within the apparatus bays. Bay doors are located at either end of the apparatus bays to allow vehicles to drive through, as needed.

Firefighters' personal protective equipment (PPE) is cleaned and decontaminated using a specialized extractor washing machine and a dryer unit where PPE is hung on drying ports to allow for no-heat drying to occur.

Administration areas generally include offices, dispatch facilities, training rooms, break rooms and conference rooms.

2.1 Station #1 – 23 Zimmerman Street, Strathroy

Station #1 consists of six (6) bays with administration offices, training room and storage rooms, throughout two floors. Station #1 is the largest of the three fire stations in the Municipality of Strathroy-Caradoc and serves as the headquarters with a reception area and offices for the Fire Chief, Deputy Chief, District Chief and Fire Prevention Officer. The original date of construction is not known but the fire department has occupied the building since 1975. It was noted to EXP that the building was a previous manufacturing facility for truck bodies.

Ceiling mounted fans are located throughout the apparatus bay and were operational at the time of the assessment. An exhaust extraction system is located in the apparatus bay and was not operational at the time of the assessment. It was noted to EXP that the exhaust extraction system is used whenever firetrucks/vehicles are running within the apparatus bay. A mixture of ceiling mounted natural gas fired unit heaters and tube heaters provide heating within the apparatus bay. None of the above noted systems were inspected as part of this assessment.

Floor drains are located throughout the apparatus bay and were not inspected as part of this assessment.

Firefighters' PPE (bunker gear) is stored within the bay floor with no physical separation from the rest of apparatus bay. Furthermore, the extractor washing machine and dryer unit are also located on the bay floor with no physical separation from the rest of the apparatus bay. It was noted to EXP that approximately five (5) sets of firefighter equipment can be decontaminated at one time. Therefore, in the event all Station #1 firefighter PPE is used, it was noted to take a few days to decontaminate and dry all PPE. Other than the exhaust extraction system used for fire station vehicles, there is no exhaust ventilation system present within Station #1.

It was noted to EXP that approximately seven (7) staff work within the administration area of Station #1. The administration area has a stand-alone HVAC system that provides heating and cooling. The HVAC system was not

inspected as part of this assessment. There is only one door that connects the administration area with the apparatus bay. The effectiveness of the seal on the door was not inspected during the assessment.

2.2 Station #2 – 688 Bowan Street, Mount Brydges

Station #2 consists of two (2) bays with administration offices, equipment decontamination room, a training room, storage room and washrooms. The station was constructed in 1994. At the time of the assessment, there was no one working within the station.

Ceiling mounted fans are located throughout the apparatus bay and were operational at the time of the assessment. An exhaust extraction system is located in the apparatus bay and was not operational at the time of the assessment. It was noted to EXP that the exhaust extraction system is used whenever firetrucks/vehicles are running within the apparatus bay. A mixture of ceiling mounted gas unit heaters and tube heaters provide heating within the apparatus bay. None of the above noted systems were inspected as part of this assessment.

Other than the exhaust extraction system used for fire station vehicles, there is no exhaust ventilation system present within the apparatus bay of Station #2.

Floor drains are located throughout the apparatus bay and were not inspected as part of this assessment.

Firefighters' PPE is stored within the bay floor with no physical separation from the rest of apparatus bay. The extractor washing machine unit is in a separate room with an exhaust fan. The effectiveness of the exhaust fan and door seal was not inspected during the assessment.

It was noted to EXP that this station is generally not staffed. The administration area has a stand-alone HVAC system that provides heating and cooling. The HVAC system was not inspected as part of this assessment. There is only one door that connects the administration area with the apparatus bay. The effectiveness of the seal on the door was not inspected during the assessment.

2.3 Station #3 – 21912 Melbourne Road, Melbourne, ON

Station #3 consists of two (2) bays with an administration office, training room, storage room, equipment decontamination area and washrooms. The station was constructed in 1997. At the time of the assessment, there was no one working at this station.

Ceiling mounted fans are located throughout the apparatus bay and were operational at the time of the assessment. An exhaust extraction system is located in the apparatus bay and was not operational at the time of the assessment. It was noted to EXP that the exhaust extraction system is used whenever firetrucks/vehicles are running within the apparatus bay. A mixture of ceiling mounted gas unit heaters and tube heaters provide heating within the apparatus bay. Within the apparatus bay there is an exhaust fan that was not operational during the assessment. None of the above noted systems were inspected as part of this assessment.

Floor drains are located throughout the apparatus bay and were not inspected as part of this assessment.

Firefighters' PPE is stored within the bay floor with no physical separation from the rest of apparatus bay. The extractor washing machine unit is in a separate room with an exhaust fan. The effectiveness of the exhaust fan and door seal was not inspected during the assessment.

It was noted to EXP that this station is generally not staffed. The administration office and training room have their own HVAC system that provides heating and cooling. The HVAC system was not inspected as part of this assessment. There is only one door that connects the administration office and training room with the apparatus bay. The effectiveness of the seal on the doors was not inspected during the assessment.

3 Previous Fires

It was noted to EXP that the following fires were the most recent to have occurred within the Municipality of Strathroy-Caradoc:

- June 6, 2023 – antique shop fire – responded to by all three fire stations.
- June 16, 2023 – car fire – responded to by Station #2 (Mount Brydges)
- June 21, 2023 – transport truck fire – responded to by Station #2 (Mount Brydges)
- July 4, 2023 – vehicle fire – responded to by Station #2 (Mount Brydges)
- August 17, 2023 – vehicle fire – responded to by Station #3 (Melbourne)
- September 10, 2023 – truck fire – responded to by Station #3 (Melbourne)
- September 23, 2023 – open burn – responded to by Station #3 (Melbourne)
- September 25, 2023 – truck fire – responded to by Station #3 (Melbourne)

It can be expected to have higher levels of certain VOCs based on the type of fire. Generally, vehicle/truck fires are associated with higher levels of the following VOCs:

- Dichlorodifluoromethane
- Benzene
- Toluene
- Propene
- *m,p,o*-Xylenes
- Styrene
- Acetone
- Acrylonitrile
- 1,3-Butadiene
- Naphthalene
- Acrolein
- 1,2,4-Trimethylbenzene
- Acetonitrile
- Chloromethane
- Ethylbenzene

4 Sampling Method

Generally, there are two sampling methods for evaluating the concentration of an air contaminant in a work environment, area air sampling and personal air sampling. It is important to understand the difference between the two sampling methods. Area air sampling is a method of sampling used to measure the environmental concentration for the evaluation of the clean level in the work environment. In contrast, personal air sampling measures the exposure concentration for the evaluation of the exposure level to the worker.

In this assessment, area air sampling was conducted to determine the environmental concentration of VOCs within the project areas. It was noted to EXP that the project areas are generally not occupied, therefore personal air sampling was not conducted for this assessment.

4.1 Area Air Sampling – VOCs

Area air samples were collected on laboratory supplied thermal desorption tubes, used to analyze specific VOCs, with the Gillian Gil Air Sampling Pump calibrated to a flow rate of 50 ml/min and analyzed in accordance with EPA TO-17 (Determination of Volatile Organic Compounds in Ambient Air).

Collected samples were transferred to a clean, labelled container for laboratory submission. Samples, alongside a field blank for quality assurance and quality control, were submitted to Cassen Testing Laboratory for open characterization analysis using thermal desorption gas chromatography/ mass spectrometry. Open characterization analyzes for the most abundant VOCs present.

The chain of custody documentation and the laboratory certificate of analysis for all submitted samples is provided in Appendix B.

5 Exposure Values and Guidelines

5.1 Individual Volatile Organic Compounds – Air

Presently there are no Canadian regulations that specify the allowable concentration of individual volatile organic compounds. However, the Ministry of the Environment, Conservations and Parks (MECP) has recommended Ambient Air Quality Criteria (AAQC) for over 350 contaminants in air. These AAQCs are considered to be the concentration of a contaminant in air that is protective against adverse effects on health and the environment. The majority of AAQCs are based on health effects.

For the purposes of this assessment, EXP compared the open characterization of VOCs concentrations to the MECP's AAQC's, where the criteria were available.

5.2 Total Volatile Organic Compounds – Air

Jurisdictions typically do not set limits for total VOCs for indoor air quality and recommend that assessment be based on individual components. However, certain guidelines have been used historically for screening assessment of total VOCs. For example, in the Health Canada Guideline, *"Indoor Air Quality in Office Buildings: A Technical Guide",* trigger and action levels for total VOC concentrations of 1,000 µg/m^3 and 5,000 µg/m^3 respectively for indoor air quality in office buildings have been established. Samples that exceed the trigger value are considered cautionary whereas samples that exceed the action value indicate the requirement for controls to be implemented in order to reduce total VOC level.

6 Sample Results

6.1 Area Air Sampling – VOCs

As part of the limited indoor air quality assessment, six (6) representative area air samples were collected and submitted for analysis. One (1) area air sample was collected from the following locations:

- Apparatus Bay at Station #1 – Sample ID: 1024025 (Strathroy A)
- Administration Area at Station #1 – Sample ID: 1024767 (Strathroy O)
- Apparatus Bay at Station #2 – Sample ID: 1175530 (Mt. Brydges A)
- Administration Area at Station #2 – Sample ID: 1024420 (Mt. Brydges O)
- Apparatus Bay at Station #3 – Sample ID: 1024993 (Melbourne A)
- Administration Area at Station #3 – Sample ID: B16865 (Melbourne O)

The following tables illustrate a list of the top 35 VOCs identified and relative concentrations on the area air samples collected:

Table 1 – Summary of Apparatus Bay Station #1 – Sample ID: 1024025 (Strathroy A)

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
1	000107-21-1	Ethylene Glycol	760	12,700
2	000109-66-0	Pentane	450	N/A
3	000064-17-5	Ethanol	250	19,000
4	000108-88-3	Toluene	130	2,000
5	000540-84-1	Pentane, 2,2,4-trimethyl-	100	N/A
6	000078-78-4	Butane, 2-methyl-	78	N/A
7	000107-83-5	Pentane, 2-methyl-	69	N/A
8	000106-97-8	Butane	56	N/A
9	000591-76-4	Hexane, 2-methyl-	54	N/A
10	000110-54-3	n-Hexane	49	2,500
11	000565-59-3	Pentane, 2,3-dimethyl-	43	N/A
12	000541-02-6	Cyclopentasiloxane, decamethyl-	43	N/A
13	000565-75-3	Pentane, 2,3,4-trimethyl-	41	N/A
14	000096-14-0	Pentane, 3-methyl-	38	N/A
15	000108-38-3	m-Xylene + p-Xylene	37	730
16	000589-34-4	Hexane, 3-methyl-	35	N/A
17	000079-29-8	Butane, 2,3-dimethyl-	30	N/A

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
18	000096-37-7	Cyclopentane, methyl-	29	N/A
19	000108-08-7	Pentane, 2,4-dimethyl-	29	N/A
20	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	26	1,000
21	000560-21-4	Pentane, 2,3,3-trimethyl-	26	N/A
22	000110-82-7	Cyclohexane	19	6,100
23	000142-82-5	Heptane	18	11,000
24	000095-16-9	Benzothiazole	18	70
25	000108-10-1	Methyl Isobutyl Ketone	17	1,200
26	002958-76-1	Naphthalene, decahydro-2-methyl-	17	N/A
27	000620-14-4	Benzene, 1-ethyl-3-methyl-	16	N/A
28	000095-63-6	Benzene, 1,2,4-trimethyl-	15	220
29	000584-94-1	Hexane, 2,3-dimethyl-	14	N/A
30	000141-93-5	Benzene, 1,3-diethyl-	14	N/A
31	000100-41-4	Ethylbenzene	14	1,000
32	000100-51-6	Benzyl Alcohol	13	880
33	004175-53-5	1H-Indene, 2,3-dihydro-1,3-dimethyl-	13	N/A
34	000095-47-6	o-Xylene	13	730
35	000075-83-2	Butane, 2,2-dimethyl-	13	N/A
Total Volatile Organic Compounds (µg/m³)				**Criteria (µg/m³)**
3,600				5,000

N/A – no criteria available
BOLD – Concentration is above MECP Ambient Air Quality Criteria
BOLD – Concentration is over Health Canada trigger level but below action level (1,000 to 5,000 µg/m³)

Table 2 – Summary of Administration Area – Station #1 – Sample ID: 1024767 (Strathroy O)

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
1	000064-17-5	Ethanol	550	19,000
2	000109-66-0	Pentane	220	N/A
3	000107-21-1	Ethylene Glycol	89	12,700
4	000108-88-3	Toluene	77	2,000
5	000541-02-6	Cyclopentasiloxane, decamethyl-	64	N/A
6	000540-84-1	Pentane, 2,2,4-trimethyl-	56	N/A
7	000591-76-4	Hexane, 2-methyl-	46	N/A
8	000078-78-4	Butane, 2-methyl-	42	N/A
9	000106-97-8	Butane	41	N/A
10	000064-19-7	Acetic acid	41	2,500
11	000107-83-5	Pentane, 2-methyl-	41	N/A
12	000589-34-4	Hexane, 3-methyl-	30	N/A
13	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	28	1,000
14	000565-59-3	Pentane, 2,3-dimethyl-	28	N/A
15	000110-54-3	n-Hexane	25	2,500
16	006846-50-0	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	21	N/A
17	000565-75-3	Pentane, 2,3,4-trimethyl-	21	N/A
18	000096-14-0	Pentane, 3-methyl-	21	N/A
19	000108-38-3	m-Xylene + p-Xylene	19	730
20	000108-08-7	Pentane, 2,4-dimethyl-	18	N/A
21	000096-37-7	Cyclopentane, methyl-	15	N/A
22	000079-29-8	Butane, 2,3-dimethyl-	14	N/A

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
23	000560-21-4	Pentane, 2,3,3-trimethyl-	13	N/A
24	000075-68-3	Ethane, 1-chloro-1,1-difluoro-	12	165
25	000142-82-5	Heptane	11	11,000
26	000110-82-7	Cyclohexane	10	6,100
27	000108-10-1	Methyl Isobutyl Ketone	9	1,200
28	000066-25-1	Hexanal	9	N/A
29	000629-50-5	Tridecane	9	N/A
30	000629-59-4	Tetradecane	9	N/A
31	000112-40-3	Dodecane	8	N/A
32	000095-16-9	Benzothiazole	8	70
33	000075-83-2	Butane, 2,2-dimethyl-	8	N/A
34	005989-27-5	D-Limonene	8	N/A
35	000584-94-1	Hexane, 2,3-dimethyl-	7	N/A
Total Volatile Organic Compounds (µg/m³)				**Criteria (µg/m³)**
2,200				5,000

N/A – no criteria available
BOLD – Concentration is above MECP Ambient Air Quality Criteria
BOLD – Concentration is over Health Canada trigger level but below action level (1,000 to 5,000 µg/m³)

Table 3 – Summary of Apparatus Bay Station #2 – Sample ID: 1175530 (Mount Brydges A)

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
1	000108-88-3	Toluene	710	2,000
2	000109-66-0	Pentane	700	N/A
3	000107-21-1	Ethylene Glycol	510	12,700
4	000107-83-5	Pentane, 2-methyl-	210	N/A
5	000110-54-3	n-Hexane	180	2,500
6	000106-97-8	Butane	180	N/A
7	000540-84-1	Pentane, 2,2,4-trimethyl-	150	N/A
8	000078-78-4	Butane, 2-methyl-	100	N/A
9	000096-14-0	Pentane, 3-methyl-	100	N/A
10	000108-38-3	m-Xylene + p-Xylene	100	730
11	000565-59-3	Pentane, 2,3-dimethyl-	82	N/A
12	000096-37-7	Cyclopentane, methyl-	70	N/A
13	000108-08-7	Pentane, 2,4-dimethyl-	70	N/A
14	000565-75-3	Pentane, 2,3,4-trimethyl-	63	N/A
15	000591-76-4	Hexane, 2-methyl-	60	N/A
16	000071-43-2	Benzene	**53**	**2.3**
17	000589-34-4	Hexane, 3-methyl-	40	N/A
18	000560-21-4	Pentane, 2,3,3-trimethyl-	39	N/A
19	000142-82-5	Heptane	38	11,000
20	000287-92-3	Cyclopentane	36	N/A
21	000100-41-4	Ethylbenzene	34	1,000
22	000095-47-6	o-Xylene	33	730
23	000079-29-8	Butane, 2,3-dimethyl-	27	N/A

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
24	000584-94-1	Hexane, 2,3-dimethyl-	26	N/A
25	000095-63-6	Benzene, 1,2,4-trimethyl-	23	220
26	000589-43-5	Hexane, 2,4-dimethyl-	23	N/A
27	000592-13-2	Hexane, 2,5-dimethyl-	22	N/A
28	000620-14-4	Benzene, 1-ethyl-3-methyl-	20	N/A
29	000104-76-7	1-Hexanol, 2-ethyl-	20	600
30	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	16	1,000
31	000110-82-7	Cyclohexane	13	6,100
32	000108-10-1	Methyl Isobutyl Ketone	13	1,200
33	000107-01-7	2-Butene	11	N/A
34	016747-26-5	Hexane, 2,2,4-trimethyl-	10	N/A
35	000095-16-9	Benzothiazole	10	70
Total Volatile Organic Compounds (µg/m³)				**Criteria (µg/m³)**
4,400				5,000

N/A – no criteria available
BOLD – Concentration is above MECP Ambient Air Quality Criteria
BOLD – Concentration is over Health Canada trigger level but below action level (1,000 to 5,000 µg/m³)

Table 4 – Summary of Administration Area – Station #2 – Sample ID: 1024420 (Mount Brydges O)

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
1	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	280	1,000
2	000107-21-1	Ethylene Glycol	210	12,700
3	000064-19-7	Acetic acid	120	2,500
4	000064-17-5	Ethanol	68	19,000
5	000108-95-2	Phenol	**38**	**30**
6	000541-02-6	Cyclopentasiloxane, decamethyl-	31	N/A
7	000109-66-0	Pentane	31	N/A
8	000066-25-1	Hexanal	20	N/A
9	000108-88-3	Toluene	17	2,000
10	000104-76-7	1-Hexanol, 2-ethyl-	16	600
11	000067-64-1	Acetone	13	11,800
12	000078-78-4	Butane, 2-methyl-	10	N/A
13	000554-12-1	Propanoic acid, methyl ester	9	N/A
14	000124-19-6	Nonanal	9	N/A
15	000107-83-5	Pentane, 2-methyl-	7	N/A
16	000106-97-8	Butane	7	N/A
17	000077-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	6	N/A
18	000115-10-6	Dimethyl ether	6	2,100
19	010042-59-8	1-Heptanol, 2-propyl-	6	N/A
20	000112-31-2	Decanal	5	N/A
21	000124-13-0	Octanal	5	N/A
22	006846-50-0	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	5	N/A

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
23	000100-52-7	Benzaldehyde	4	N/A
24	000095-16-9	Benzothiazole	4	70
25	000108-38-3	m-Xylene + p-Xylene	4	730
26	074367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester	4	N/A
27	000540-84-1	Pentane, 2,2,4-trimethyl-	4	N/A
28	000591-76-4	Hexane, 2-methyl-	4	N/A
29	000108-94-1	Cyclohexanone	4	N/A
30	000124-07-2	Octanoic Acid	3	N/A
31	000565-59-3	Pentane, 2,3-dimethyl-	3	N/A
32	000556-67-2	Cyclotetrasiloxane, octamethyl-	3	N/A
33	000143-08-8	1-Nonanol	3	N/A
34	000111-14-8	Heptanoic acid	3	N/A
35	000110-82-7	Cyclohexane	3	6,100
Total Volatile Organic Compounds (µg/m³)				**Criteria (µg/m³)**
1,200				5,000

N/A – no criteria available
BOLD – Concentration is above MECP Ambient Air Quality Criteria
BOLD – Concentration is over Health Canada trigger level but below action level (1,000 to 5,000 µg/m³)

Table 5 – Summary of Apparatus Bay Station #3 – Sample ID: 1024993 (Melbourne A)

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
1	000109-66-0	Pentane	460	N/A
2	000107-21-1	Ethylene Glycol	230	12,700
3	000108-88-3	Toluene	200	2,000
4	000540-84-1	Pentane, 2,2,4-trimethyl-	180	N/A
5	000078-78-4	Butane, 2-methyl-	110	N/A
6	000107-83-5	Pentane, 2-methyl-	99	N/A
7	000064-17-5	Ethanol	99	19,000
8	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	95	1,000
9	000071-43-2	Benzene	**94**	**2.3**
10	000565-75-3	Pentane, 2,3,4-trimethyl-	78	180
11	000106-97-8	Butane	68	N/A
12	000565-59-3	Pentane, 2,3-dimethyl-	57	N/A
13	000108-08-7	Pentane, 2,4-dimethyl-	47	N/A
14	000560-21-4	Pentane, 2,3,3-trimethyl-	45	N/A
15	000108-38-3	m-Xylene + p-Xylene	43	730
16	000096-14-0	Pentane, 3-methyl-	42	N/A
17	000110-54-3	n-Hexane	41	2,500
18	000096-37-7	Cyclopentane, methyl-	34	N/A
19	000079-29-8	Butane, 2,3-dimethyl-	31	N/A
20	000584-94-1	Hexane, 2,3-dimethyl-	30	N/A
21	000592-13-2	Hexane, 2,5-dimethyl-	26	N/A
22	000589-43-5	Hexane, 2,4-dimethyl-	25	N/A
23	000591-76-4	Hexane, 2-methyl-	24	N/A

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
24	000110-82-7	Cyclohexane	22	6,100
25	000075-83-2	Butane, 2,2-dimethyl-	21	N/A
26	000104-76-7	1-Hexanol, 2-ethyl-	21	600
27	000108-10-1	Methyl Isobutyl Ketone	18	1,200
28	000513-35-9	2-Butene, 2-methyl-	17	N/A
29	000100-41-4	Ethylbenzene	17	1,000
30	000095-47-6	o-Xylene	16	730
31	000620-14-4	Benzene, 1-ethyl-3-methyl-	15	N/A
32	000589-34-4	Hexane, 3-methyl-	15	N/A
33	000095-63-6	Benzene, 1,2,4-trimethyl-	14	220
34	000095-16-9	Benzothiazole	14	70
35	000067-64-1	Acetone	14	11,880
Total Volatile Organic Compounds (µg/m³)				**Criteria (µg/m³)**
3,000				5,000

N/A – no criteria available
BOLD – Concentration is above MECP Ambient Air Quality Criteria
BOLD – Concentration is over Health Canada trigger level but below action level (1,000 to 5,000 µg/m³)

Table 6 – Summary of Administration Area – Station #3 – Sample ID: B16865 (Melbourne O)

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
1	000109-66-0	Pentane	28	N/A
2	000064-17-5	Ethanol	26	19,000
3	000064-19-7	Acetic acid	24	2,500
4	000107-21-1	Ethylene Glycol	22	12,700
5	000078-78-4	Butane, 2-methyl-	11	N/A
6	000108-88-3	Toluene	8	2,000
7	000540-84-1	Pentane, 2,2,4-trimethyl-	7	N/A
8	000287-92-3	Cyclopentane	7	N/A
9	000106-97-8	Butane	6	N/A
10	000107-83-5	Pentane, 2-methyl-	4	N/A
11	N.A.	3-Chloro-2,3,3-trifluoroprop-1-ene	4	N/A
12	000071-43-2	Benzene	**4**	**2.3**
13	000104-76-7	1-Hexanol, 2-ethyl-	4	600
14	000110-82-7	Cyclohexane	4	6,100
15	000565-75-3	Pentane, 2,3,4-trimethyl-	3	N/A
16	000541-02-6	Cyclopentasiloxane, decamethyl-	3	N/A
17	000064-18-6	Formic acid	3	500
18	000565-59-3	Pentane, 2,3-dimethyl-	3	N/A
19	000108-08-7	Pentane, 2,4-dimethyl-	2	N/A
20	000096-14-0	Pentane, 3-methyl-	2	N/A
21	000079-29-8	Butane, 2,3-dimethyl-	2	N/A
22	000110-54-3	n-Hexane	2	2,500
23	000075-83-2	Butane, 2,2-dimethyl-	2	N/A

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
24	000108-38-3	m-Xylene + p-Xylene	2	730
25	000560-21-4	Pentane, 2,3,3-trimethyl-	2	N/A
26	000095-16-9	Benzothiazole	2	70
27	000080-56-8	alpha-Pinene	2	N/A
28	000096-37-7	Cyclopentane, methyl-	2	N/A
29	000075-07-0	Acetaldehyde	2	500
30	000075-69-4	Trichloromonofluoromethane	1	N/A
31	000556-67-2	Cyclotetrasiloxane, octamethyl-	1	N/A
32	000592-13-2	Hexane, 2,5-dimethyl-	1	N/A
33	000067-64-1	Acetone	1	11,880
34	000100-52-7	Benzaldehyde	1	N/A
35	000056-23-5	Carbon Tetrachloride	1	2.4
Total Volatile Organic Compounds (µg/m³)				**Criteria (µg/m³)**
260				5,000

N/A – no criteria available
BOLD – Concentration is above MECP Ambient Air Quality Criteria
BOLD – Concentration is over Health Canada trigger level but below action level (1,000 to 5,000 µg/m³)

Table 7 – Summary of Blank Sample Analysis – Sample ID: H0258026 (Field Blank)

#	CAS Number	Tentative Identification	Concentration (µg/m³)	Criteria (µg/m³)
1	000526-73-8	Benzene, 1,2,3-trimethyl-	<LOD	220
2	000103-65-1	Benzene, propyl-	<LOD	N/A
Total Volatile Organic Compounds (µg/m³)				**Criteria (µg/m³)**
<LOD				5,000

<LOD – less than laboratory limit of detection
N/A – no criteria available
BOLD – Concentration is above MECP Ambient Air Quality Criteria
BOLD – Concentration is over Health Canada trigger level but below action level (1,000 to 5,000 µg/m³)

6.2 Quality Assurance/Quality Control

6.2.1 Field – General

Quality assurance measures taken included assigning unique sample numbers, Chain of Custody documentation, and collection of field blank samples to be submitted alongside the other samples.

6.2.2 Laboratory – General

All air samples collected during this investigation were submitted to Cassen Testing Laboratory (Cassen).

Cassen is fully accredited by the American Industrial Hygiene Association Laboratory Accreditation Program, LLC (AIHA-LAP, LLC). AIHA-LAP, LLC accreditation fully meets the 2005 ISO 17025 (E) standards. Samples submitted to Cassen were assessed in accordance with accordance with EPA TO-17 (Determination of Volatile Organic Compounds in Ambient Air) and analyzed using thermal desorption gas chromatography/ mass spectrometry.

Certificates of analysis for all samples submitted to Cassen in Appendix A.

7 Assessment and Conclusions

The limited indoor air quality assessment conducted at the three (3) fire stations within the Municipality of Strathroy-Caradoc on September 25, 2023, and consisted of six (6) area air VOC samples. The area air samples were taken within the administration areas and apparatus bays of each fire station.

7.1 Individual Volatile Organic Compounds – Air

Individual concentrations of specific VOCs from the area air samples collected with the administration areas and apparatus bays ranged from 1 µg/m^3 up to 760 µg/m^3. Presently there are no Canadian regulations that specify the allowable concentration of individual VOCs. Individual VOC contamination in air exceed the MECP's AAQC for at four (4) locations.

- Sample ID: 1175530, taken within the apparatus bay of Station #2 (Mount Brydges), was identified to have benzene levels of 53 µg/m^3, which far exceeds the recommended concentration limit of 2.3 µg/m^3.
- Sample ID: 1024420, taken within the administration area of Station #2 (Mount Brydges), was identified to have phenol levels of 38 µg/m^3, which exceeds the recommended concentration limit of 30 µg/m^3.
- Sample ID: 1024993, taken within the apparatus bay of Station #3 (Melbourne), was identified to have benzene levels of 94 µg/m^3, which far exceeds the recommended concentration limit of 2.3 µg/m^3.
- Sample ID: B16865, taken within the administration area of Station #3 (Melbourne), was identified to have benzene levels of 4 µg/m^3, which exceeds the recommended concentration limit of 2.3 µg/m^3.
- All other individual VOCs identified were below their respective recommended concentration limits, where AAQC was available.

7.2 Total Volatile Organic Compounds – Air

Total concentration of VOCs from the area air samples collected within the administration areas and apparatus bays ranged from 260 µg/m^3 up to 4,400 µg/m^3. Currently there is not regulated limits for total VOCs for indoor air quality but for this assessment, Health Canada trigger and action levels have been used. Total VOCs in air exceeded the Health Canada trigger level in five (5) locations.

- Sample ID: 1024025, taken within the apparatus bay of Station #1 (Strathroy), was identified to have total VOC levels of 3,600 µg/m^3, that exceeded the recommended trigger level of 1,000 µg/m^3 but was below the action level of 5,000 µg/m^3.
- Sample ID: 1024767, taken within the administration area of Station #1 (Strathroy), was identified to have total VOC levels of 2,200 µg/m^3, that far exceeded the recommended trigger level of 1,000 µg/m^3 but was below the action level of 5,000 µg/m^3.
- Sample ID: 1175530, taken within the apparatus bay of Station #2 (Mount Brydges), was identified to have total VOC levels of 4,400 µg/m^3, that exceeded the recommended trigger level of 1,000 µg/m^3 but was below the action level of 5,000 µg/m^3.
- Sample ID: 1024420, taken within the administration area of Station #2 (Mount Brydges), was identified to have total VOC levels of 1,200 µg/m^3, that exceeded the recommended trigger level of 1,000 µg/m^3 but was below the action level of 5,000 µg/m^3.
- Sample ID: 1024993, taken within the apparatus bay of Station #3 (Melbourne), was identified to have total VOC levels of 3,000 µg/m^3, that exceeded the recommended trigger level of 1,000 µg/m^3 but was below the action level of 5,000 µg/m^3.
- All other area air samples were identified to be far below the recommended trigger levels for total VOCs.
- All total VOC concentrations within the administration areas of all three fire stations were lower when compared to the total VOC concentrations within the respective apparatus bays.

8 Recommendations

Based on the analytical results for the fire stations, the following recommendations are provided for consideration.

- Further investigation into the source of higher concentrations of individual VOCs within the administration areas of the fire stations, specifically phenol levels in Station #2 and benzene levels in Station #3.
- Further investigation into the source of higher concentrations of individual VOCs within the apparatus bays of the fire stations, specifically benzene levels in Station #2 and Station #3.
- Review total VOC mitigation measures based on hierarchy of controls (i.e., elimination, substitution, engineering controls, administrative controls, personal protective equipment) such as:
    a. Removal of firefighter PPE storage from within the apparatus bay and/or having separate storage location that can be sealed from the general area.
    b. Increase general ventilation throughout the apparatus bays, specifically in areas where firefighter PPE is stored.
    c. Review feasibility of adding an air purifying system that contains activated carbon to aid in filtration of VOCs in air.
    d. Inspect the exhaust extraction systems within the fire stations to ensure contaminants from firetruck/vehicle operation are being removed as intended.
        i. Perform any preventative maintenance and/or repairs on the exhaust extraction system, as identified.
    e. Inspect heating and cooling systems within the fire stations to determine if VOC extraction systems can be added to existing systems.
    f. Inspect the floor drains within the apparatus bays of all fire stations to ensure proper function and verify sewage gases are not entering the area.
    g. Administrative controls with respect to monitoring, access and training.
- In the event of a major fire, conduct air sampling to assess the VOC concentrations pre- and post-decontamination activities of firefighters PPE.
- Conduction further indoor air quality assessment for common parameters (temperature, relative humidity, carbon dioxide, carbon monoxide, inhalable particulate, etc.) to assess if there are any other air contaminants of concerns within the fire stations.

9 General Limitations

The information in this report is considered to be privileged and confidential and has been prepared exclusively for the Municipality of Strathroy-Caradoc. The purpose of this report is to provide the Municipality of Strathroy-Caradoc with an assessment of the VOC concentrations in the apparatus bays and administration areas of three (3) fire stations within the Municipality of Strathroy-Caradoc. The information presented in this report is based on information provided by others and visual observations as identified herein. Achieving the objectives stated in this report has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to an acceptable level. Professional judgment was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional people rendering advice, we do not act as absolute insurers of the conclusions we reach, but we commit ourselves to care and competence in reaching those conclusions.

Any changes to operations such as the introduction of new processes and/or alterations to air-handling equipment may render the conclusions of this report inaccurate or invalid. In the event of any such changes, EXP should be contacted to re-evaluate the conditions within the tested areas and make appropriate revisions to the original conclusions of this report.

This report was prepared for the exclusive use of the Municipality of Strathroy-Caradoc and may not be reproduced in whole or in part, without the prior written consent of EXP, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust the aforementioned meets your immediate requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

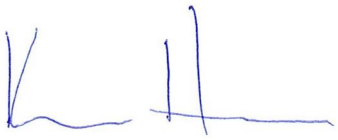
Sincerely,

EXP Services Inc.

Written By:

Ali Ismail, CRSP, CIH
Certified Industrial Hygienist
Hazardous Materials
Environmental Division
EXP Services Inc.

Reviewed By:



Keith Hill, C.E.T.
Regional Team Lead, SW Ontario
Hazardous Materials
Environmental Division
EXP Services Inc.

Appendix A – Laboratory Certificate of Analysis

CASSEN Testing Laboratories

Division of CASSEN Group Inc.

Advanced Scientific Solutions

51 International Blvd. Etobicoke, ON Canada M9W 6H3
Tel: (416) 679-9663 Toll Free: 1-866-423-3001 Fax: (416) 679-9668
info@cassen.ca www.cassen.ca

October 04, 2023

Ali Ismail
exp. Services Inc.
15701 Robin's Hill Road
London, Ontario
N5V 0A5

RE: Analytical Report for exp. Services Inc. Project: LON 23011333.AO
CASSEN Work Order No. 2513536

Dear Ali,

We have completed the analysis of 7 AT-TUBE samples that you submitted on September 27, 2023 for open characterization analysis using thermal desorption gas chromatography/mass spectrometry. Results of the analysis are summarized in the attached report, which includes the semi-quantitative concentrations of the top major VOCs identified, CAS numbers, TVOCs values, and the corresponding chromatograms. A summary of compounds detected, their relevant sources, available exposure limits and odours are attached for your information.

Ali, please feel free to give me a call at (416) 679-9663 should you need any clarification. Thank you for using our services.

Sincerely,

CASSEN Testing Laboratories

Cecilia Chan, M.Sc., C.Chem
Laboratory Director

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
CECILIA C. CHAN
CHEMIST

CASSEN Testing Laboratories
Division of CASSEN Group Inc.
Advanced Scientific Solutions
51 International Blvd., Etobicoke, ON Canada M9W 6H3
Tel: (416) 679-9663 Toll Free: 1-866-423-3001 Fax: (416) 679-9668
www.cassen.ca

October 04, 2023

exp. Services Inc.
ATTN: Ali Ismail
15701 Robin's Hill Road
London, Ontario, N5V 0A5

Analytical Report

CASSEN Work Order #: 2513536
Date Received: Sep. 27, 2023
Client Project Name / No.: LON 23011333.AO

# of Samples	Analysis Requested
7	Open characterization

CASSEN Testing Laboratories
51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization: exp. Services Inc.
Address: 15701 Robin's Hill Road , London, Ontario, N5V 0A5
Contact: Ali Ismail
Project: LON 23011333.AO

Work Order No.: 2513536
Date Submitted: September 27, 2023
Date Analyzed: September 28, 2023

Analysis Requested: Open Characterization
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2401
Reference Method: EPA TO-17/ISO 16017
Sampling Media: AT-TUBE

No. of Samples: 6
No. of Blanks: 1
Analyst: TL
Reviewer: MB

Sample Identification: 1175530 (Mt. Brydges A)

CASSEN ID: 103355
Date Sampled: September 25, 2023
Date Analyzed: September 28, 2023

Sample Volume (L): 11.531 **GC/MS File: K06541.D**

#	CAS Number	Tentative Identification	R.T. (min)	Amount (ng)	Conc. (µg/m³)
1	000108-88-3	Toluene	18.17	8200	710
2	000109-66-0	Pentane	6.13	8100	700
3	000107-21-1	Ethylene Glycol	19.16	5900	510
4	000107-83-5	Pentane, 2-methyl-	8.20	2400	210
5	000110-54-3	n-Hexane	9.39	2100	180
6	000106-97-8	Butane	4.50	2000	180
7	000540-84-1	Pentane, 2,2,4-trimethyl-	13.37	1800	150
8	000078-78-4	Butane, 2-methyl-	5.59	1200	100
9	000096-14-0	Pentane, 3-methyl-	8.77	1200	100
10	000108-38-3	m-Xylene + p-Xylene	22.85	1200	100
11	000565-59-3	Pentane, 2,3-dimethyl-	12.50	940	82
12	000096-37-7	Cyclopentane, methyl-	10.83	810	70
13	000108-08-7	Pentane, 2,4-dimethyl-	10.62	810	70
14	000565-75-3	Pentane, 2,3,4-trimethyl-	16.37	730	63
15	000591-76-4	Hexane, 2-methyl-	12.30	690	60
16	000071-43-2	Benzene	13.20	610	53
17	000589-34-4	Hexane, 3-methyl-	12.74	470	40
18	000560-21-4	Pentane, 2,3,3-trimethyl-	16.69	450	39
19	000142-82-5	Heptane	13.82	440	38
20	000287-92-3	Cyclopentane	8.32	410	36
21	000100-41-4	Ethylbenzene	22.50	390	34
22	000095-47-6	o-Xylene	24.04	380	33
23	000079-29-8	Butane, 2,3-dimethyl-	8.12	310	27
24	000584-94-1	Hexane, 2,3-dimethyl-	16.75	300	26
25	000095-63-6	Benzene, 1,2,4-trimethyl-	27.88	270	23
26	000589-43-5	Hexane, 2,4-dimethyl-	15.43	260	23
27	000592-13-2	Hexane, 2,5-dimethyl-	15.28	260	22
28	000620-14-4	Benzene, 1-ethyl-3-methyl-	26.62	230	20
29	000104-76-7	1-Hexanol, 2-ethyl-	29.34	230	20
30	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	11.23	190	16
31	000110-82-7	Cyclohexane	12.42	150	13
32	000108-10-1	Methyl Isobutyl Ketone	17.68	150	13
33	000107-01-7	2-Butene	4.66	130	11
34	016747-26-5	Hexane, 2,2,4-trimethyl-	17.73	120	10
35	000095-16-9	Benzothiazole	35.06	120	10

Total Volatile Organic Compounds		
	Total Amount (ng)	**Total Concentration (µg/m³)**
TVOCs	51000	4400

See Final Page for Notes

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization: exp. Services Inc.
Address: 15701 Robin's Hill Road , London, Ontario, N5V 0A5
Contact: Ali Ismail
Project: LON 23011333.AO

Work Order No.: 2513536
Date Submitted: September 27, 2023
Date Analyzed: September 28, 2023

Analysis Requested: Open Characterization
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2401
Reference Method: EPA TO-17/ISO 16017
Sampling Media: AT-TUBE

No. of Samples: 6
No. of Blanks: 1
Analyst: TL
Reviewer: MB

Sample Identification: 1024420 (Mt. Brydges O)

CASSEN ID: 103356
Date Sampled: September 25, 2023
Date Analyzed: September 28, 2023

Sample Volume (L): 11.467 **GC/MS File: K06542.D**

#	CAS Number	Tentative Identification	R.T. (min)	Amount (ng)	Conc. (µg/m³)
1	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	10.92	3200	280
2	000107-21-1	Ethylene Glycol	19.33	2400	210
3	000064-19-7	Acetic acid	14.34	1300	120
4	000064-17-5	Ethanol	5.95	770	68
5	000108-95-2	Phenol	30.01	430	38
6	000541-02-6	Cyclopentasiloxane, decamethyl-	30.91	360	31
7	000109-66-0	Pentane	5.56	350	31
8	000066-25-1	Hexanal	20.23	220	20
9	000108-88-3	Toluene	18.10	200	17
10	000104-76-7	1-Hexanol, 2-ethyl-	29.33	180	16
11	000067-64-1	Acetone	6.75	150	13
12	000078-78-4	Butane, 2-methyl-	5.01	110	10
13	000554-12-1	Propanoic acid, methyl ester	11.80	100	9
14	000124-19-6	Nonanal	31.27	100	9
15	000107-83-5	Pentane, 2-methyl-	7.71	80	7
16	000106-97-8	Butane	3.90	76	7
17	000077-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	37.51	74	6
18	000115-10-6	Dimethyl ether	3.61	71	6
19	010042-59-8	1-Heptanol, 2-propyl-	33.77	69	6
20	000112-31-2	Decanal	33.60	57	5
21	000124-13-0	Octanal	28.41	54	5
22	006846-50-0	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	41.37	53	5
23	000100-52-7	Benzaldehyde	27.94	50	4
24	000095-16-9	Benzothiazole	35.07	50	4
25	000108-38-3	m-Xylene + p-Xylene	22.82	48	4
26	074367-33-2	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester	37.31	43	4
27	000540-84-1	Pentane, 2,2,4-trimethyl-	13.14	43	4
28	000591-76-4	Hexane, 2-methyl-	12.02	43	4
29	000108-94-1	Cyclohexanone	25.40	41	4
30	000124-07-2	Octanoic Acid	33.40	40	3
31	000565-59-3	Pentane, 2,3-dimethyl-	12.23	38	3
32	000556-67-2	Cyclotetrasiloxane, octamethyl-	26.19	38	3
33	000143-08-8	1-Nonanol	30.48	37	3
34	000111-14-8	Heptanoic acid	28.70	36	3
35	000110-82-7	Cyclohexane	12.14	36	3

Total Volatile Organic Compounds		
	Total Amount (ng)	**Total Concentration (µg/m³)**
TVOCs	13000	1200

See Final Page for Notes

CASSEN Testing Laboratories
51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization: exp. Services Inc.
Address: 15701 Robin's Hill Road , London, Ontario, N5V 0A5
Contact: Ali Ismail
Project: LON 23011333.AO

Work Order No.: 2513536
Date Submitted: September 27, 2023
Date Analyzed: September 28, 2023

Analysis Requested: Open Characterization
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2401
Reference Method: EPA TO-17/ISO 16017
Sampling Media: AT-TUBE

No. of Samples: 6
No. of Blanks: 1
Analyst: TL
Reviewer: MB

Sample Identification: 1024993 (Melbourne A)

CASSEN ID: 103357
Date Sampled: September 25, 2023
Date Analyzed: September 28, 2023

Sample Volume (L): 11.058 **GC/MS File: K06543.D**

#	CAS Number	Tentative Identification	R.T. (min)	Amount (ng)	Conc. (µg/m³)
1	000109-66-0	Pentane	5.59	5100	460
2	000107-21-1	Ethylene Glycol	19.39	2500	230
3	000108-88-3	Toluene	18.08	2200	200
4	000540-84-1	Pentane, 2,2,4-trimethyl-	13.14	2000	180
5	000078-78-4	Butane, 2-methyl-	5.03	1200	110
6	000107-83-5	Pentane, 2-methyl-	7.75	1100	99
7	000064-17-5	Ethanol	5.97	1100	99
8	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	10.95	1000	95
9	000071-43-2	Benzene	12.96	1000	94
10	000565-75-3	Pentane, 2,3,4-trimethyl-	16.23	870	78
11	000106-97-8	Butane	3.92	750	68
12	000565-59-3	Pentane, 2,3-dimethyl-	12.24	630	57
13	000108-08-7	Pentane, 2,4-dimethyl-	10.29	520	47
14	000560-21-4	Pentane, 2,3,3-trimethyl-	16.55	500	45
15	000108-38-3	m-Xylene + p-Xylene	22.80	480	43
16	000096-14-0	Pentane, 3-methyl-	8.34	460	42
17	000110-54-3	n-Hexane	9.00	450	41
18	000096-37-7	Cyclopentane, methyl-	10.50	380	34
19	000079-29-8	Butane, 2,3-dimethyl-	7.66	340	31
20	000584-94-1	Hexane, 2,3-dimethyl-	16.62	330	30
21	000592-13-2	Hexane, 2,5-dimethyl-	15.12	290	26
22	000589-43-5	Hexane, 2,4-dimethyl-	15.27	280	25
23	000591-76-4	Hexane, 2-methyl-	12.04	260	24
24	000110-82-7	Cyclohexane	12.15	240	22
25	000075-83-2	Butane, 2,2-dimethyl-	6.61	230	21
26	000104-76-7	1-Hexanol, 2-ethyl-	29.33	230	21
27	000108-10-1	Methyl Isobutyl Ketone	17.58	200	18
28	000513-35-9	2-Butene, 2-methyl-	6.30	190	17
29	000100-41-4	Ethylbenzene	22.46	180	17
30	000095-47-6	o-Xylene	24.01	170	16
31	000620-14-4	Benzene, 1-ethyl-3-methyl-	26.60	170	15
32	000589-34-4	Hexane, 3-methyl-	12.50	160	15
33	000095-63-6	Benzene, 1,2,4-trimethyl-	27.86	160	14
34	000095-16-9	Benzothiazole	35.06	150	14
35	000067-64-1	Acetone	6.76	150	14

Total Volatile Organic Compounds		
	Total Amount (ng)	**Total Concentration (µg/m³)**
TVOCs	34000	3000

See Final Page for Notes

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization: exp. Services Inc.
Address: 15701 Robin's Hill Road , London, Ontario, N5V 0A5
Contact: Ali Ismail
Project: LON 23011333.AO

Work Order No.: 2513536
Date Submitted: September 27, 2023
Date Analyzed: September 28, 2023

Analysis Requested: Open Characterization
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2401
Reference Method: EPA TO-17/ISO 16017
Sampling Media: AT-TUBE

No. of Samples: 6
No. of Blanks: 1
Analyst: TL
Reviewer: MB

Sample Identification: B16865 (Melbourne O)

CASSEN ID: 103358
Date Sampled: September 25, 2023
Date Analyzed: September 28, 2023

Sample Volume (L): 11.138 **GC/MS File: K06544.D**

#	CAS Number	Tentative Identification	R.T. (min)	Amount (ng)	Conc. (µg/m³)
1	000109-66-0	Pentane	5.60	310	28
2	000064-17-5	Ethanol	6.59	280	26
3	000064-19-7	Acetic acid	14.30	270	24
4	000107-21-1	Ethylene Glycol	19.30	250	22
5	000078-78-4	Butane, 2-methyl-	5.03	130	11
6	000108-88-3	Toluene	18.09	90	8
7	000540-84-1	Pentane, 2,2,4-trimethyl-	13.13	81	7
8	000287-92-3	Cyclopentane	7.89	77	7
9	000106-97-8	Butane	3.91	69	6
10	000107-83-5	Pentane, 2-methyl-	7.77	48	4
11	N.A.	3-Chloro-2,3,3-trifluoroprop-1-ene	4.41	46	4
12	000071-43-2	Benzene	12.98	42	4
13	000104-76-7	1-Hexanol, 2-ethyl-	29.34	40	4
14	000110-82-7	Cyclohexane	12.15	40	4
15	000565-75-3	Pentane, 2,3,4-trimethyl-	16.22	35	3
16	000541-02-6	Cyclopentasiloxane, decamethyl-	30.91	34	3
17	000064-18-6	Formic acid	14.19	30	3
18	000565-59-3	Pentane, 2,3-dimethyl-	12.24	29	3
19	000108-08-7	Pentane, 2,4-dimethyl-	10.29	22	2
20	000096-14-0	Pentane, 3-methyl-	8.35	22	2
21	000079-29-8	Butane, 2,3-dimethyl-	7.67	22	2
22	000110-54-3	n-Hexane	9.01	22	2
23	000075-83-2	Butane, 2,2-dimethyl-	6.62	21	2
24	000108-38-3	m-Xylene + p-Xylene	22.81	20	2
25	000560-21-4	Pentane, 2,3,3-trimethyl-	16.55	19	2
26	000095-16-9	Benzothiazole	35.07	19	2
27	000080-56-8	.alpha.-Pinene	25.07	18	2
28	000096-37-7	Cyclopentane, methyl-	10.51	18	2
29	000075-07-0	Acetaldehyde	4.17	17	2
30	000075-69-4	Trichloromonofluoromethane	5.45	17	1
31	000556-67-2	Cyclotetrasiloxane, octamethyl-	26.19	15	1
32	000592-13-2	Hexane, 2,5-dimethyl-	15.12	15	1
33	000067-64-1	Acetone	6.94	14	1
34	000100-52-7	Benzaldehyde	27.98	14	1
35	000056-23-5	Carbon Tetrachloride	12.44	13	1

Total Volatile Organic Compounds		
	Total Amount (ng)	**Total Concentration (µg/m³)**
TVOCs	2900	260

See Final Page for Notes

CASSEN Testing Laboratories
51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization: exp. Services Inc.
Address: 15701 Robin's Hill Road , London, Ontario, N5V 0A5
Contact: Ali Ismail
Project: LON 23011333.AO

Work Order No.: 2513536
Date Submitted: September 27, 2023
Date Analyzed: September 28, 2023

Analysis Requested: Open Characterization
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2401
Reference Method: EPA TO-17/ISO 16017
Sampling Media: AT-TUBE

No. of Samples: 6
No. of Blanks: 1
Analyst: TL
Reviewer: MB

Sample Identification: 1024025 (Strathroy A)

CASSEN ID: 103359
Date Sampled: September 25, 2023
Date Analyzed: September 28, 2023

Sample Volume (L): 11.028 **GC/MS File: K06546.D**

#	CAS Number	Tentative Identification	R.T. (min)	Amount (ng)	Conc. (µg/m³)
1	000107-21-1	Ethylene Glycol	18.64	8400	760
2	000109-66-0	Pentane	5.62	4900	450
3	000064-17-5	Ethanol	5.92	2700	250
4	000108-88-3	Toluene	18.09	1500	130
5	000540-84-1	Pentane, 2,2,4-trimethyl-	13.15	1100	100
6	000078-78-4	Butane, 2-methyl-	5.06	860	78
7	000107-83-5	Pentane, 2-methyl-	7.79	760	69
8	000106-97-8	Butane	3.93	620	56
9	000591-76-4	Hexane, 2-methyl-	12.06	600	54
10	000110-54-3	n-Hexane	9.02	540	49
11	000565-59-3	Pentane, 2,3-dimethyl-	12.26	480	43
12	000541-02-6	Cyclopentasiloxane, decamethyl-	30.91	470	43
13	000565-75-3	Pentane, 2,3,4-trimethyl-	16.24	450	41
14	000096-14-0	Pentane, 3-methyl-	8.38	420	38
15	000108-38-3	m-Xylene + p-Xylene	22.81	410	37
16	000589-34-4	Hexane, 3-methyl-	12.51	380	35
17	000079-29-8	Butane, 2,3-dimethyl-	7.69	330	30
18	000096-37-7	Cyclopentane, methyl-	10.52	320	29
19	000108-08-7	Pentane, 2,4-dimethyl-	10.31	320	29
20	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	10.91	290	26
21	000560-21-4	Pentane, 2,3,3-trimethyl-	16.56	290	26
22	000110-82-7	Cyclohexane	12.17	210	19
23	000142-82-5	Heptane	13.63	200	18
24	000095-16-9	Benzothiazole	35.07	190	18
25	000108-10-1	Methyl Isobutyl Ketone	17.56	190	17
26	002958-76-1	Naphthalene, decahydro-2-methyl-	31.21	190	17
27	000620-14-4	Benzene, 1-ethyl-3-methyl-	26.60	180	16
28	000095-63-6	Benzene, 1,2,4-trimethyl-	27.87	170	15
29	000584-94-1	Hexane, 2,3-dimethyl-	16.63	150	14
30	000141-93-5	Benzene, 1,3-diethyl-	29.67	150	14
31	000100-41-4	Ethylbenzene	22.46	150	14
32	000100-51-6	Benzyl Alcohol	30.64	150	13
33	004175-53-5	1H-Indene, 2,3-dihydro-1,3-dimethyl-	33.61	140	13
34	000095-47-6	o-Xylene	24.01	140	13
35	000075-83-2	Butane, 2,2-dimethyl-	6.64	140	13

Total Volatile Organic Compounds		
	Total Amount (ng)	**Total Concentration (µg/m³)**
TVOCs	39000	3600

See Final Page for Notes

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization: exp. Services Inc.
Address: 15701 Robin's Hill Road , London, Ontario, N5V 0A5
Contact: Ali Ismail
Project: LON 23011333.AO

Work Order No.: 2513536
Date Submitted: September 27, 2023
Date Analyzed: September 28, 2023

Analysis Requested: Open Characterization
Instrument: Thermal Desorption with Gas Chromatography Mass Spectrometry
CASSEN Method: M.2401
Reference Method: EPA TO-17/ISO 16017
Sampling Media: AT-TUBE

No. of Samples: 6
No. of Blanks: 1
Analyst: TL
Reviewer: MB

Sample Identification: 1024767 (Strathroy O)

CASSEN ID: 103360
Date Sampled: September 25, 2023
Date Analyzed: September 28, 2023

Sample Volume (L): 11.022 **GC/MS File: K06545.D**

#	CAS Number	Tentative Identification	R.T. (min)	Amount (ng)	Conc. (µg/m³)
1	000064-17-5	Ethanol	5.86	6100	550
2	000109-66-0	Pentane	5.63	2400	220
3	000107-21-1	Ethylene Glycol	20.00	980	89
4	000108-88-3	Toluene	18.09	850	77
5	000541-02-6	Cyclopentasiloxane, decamethyl-	30.91	700	64
6	000540-84-1	Pentane, 2,2,4-trimethyl-	13.15	610	56
7	000591-76-4	Hexane, 2-methyl-	12.05	500	46
8	000078-78-4	Butane, 2-methyl-	5.06	460	42
9	000106-97-8	Butane	3.94	450	41
10	000064-19-7	Acetic acid	13.77	450	41
11	000107-83-5	Pentane, 2-methyl-	7.79	450	41
12	000589-34-4	Hexane, 3-methyl-	12.50	330	30
13	000078-93-3	2-Butanone (Methyl Ethyl Ketone)	10.90	310	28
14	000565-59-3	Pentane, 2,3-dimethyl-	12.26	310	28
15	000110-54-3	n-Hexane	9.03	280	25
16	006846-50-0	2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	41.37	230	21
17	000565-75-3	Pentane, 2,3,4-trimethyl-	16.23	230	21
18	000096-14-0	Pentane, 3-methyl-	8.38	230	21
19	000108-38-3	m-Xylene + p-Xylene	22.81	210	19
20	000108-08-7	Pentane, 2,4-dimethyl-	10.31	200	18
21	000096-37-7	Cyclopentane, methyl-	10.52	170	15
22	000079-29-8	Butane, 2,3-dimethyl-	7.69	150	14
23	000560-21-4	Pentane, 2,3,3-trimethyl-	16.56	150	13
24	000075-68-3	Ethane, 1-chloro-1,1-difluoro-	3.64	130	12
25	000142-82-5	Heptane	13.63	120	11
26	000110-82-7	Cyclohexane	12.17	110	10
27	000108-10-1	Methyl Isobutyl Ketone	17.56	97	9
28	000066-25-1	Hexanal	20.24	96	9
29	000629-50-5	Tridecane	34.47	96	9
30	000629-59-4	Tetradecane	36.26	96	9
31	000112-40-3	Dodecane	32.41	93	8
32	000095-16-9	Benzothiazole	35.06	91	8
33	000075-83-2	Butane, 2,2-dimethyl-	6.64	88	8
34	005989-27-5	D-Limonene	28.57	87	8
35	000584-94-1	Hexane, 2,3-dimethyl-	16.63	79	7

Total Volatile Organic Compounds		
	Total Amount (ng)	**Total Concentration (µg/m³)**
TVOCs	25000	2200

See Final Page for Notes

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization:	exp. Services Inc.		
Address:	15701 Robin's Hill Road , London, Ontario, N5V 0A5		
Contact:	Ali Ismail	**Work Order No.:**	2513536
Project:	LON 23011333.AO	**Date Submitted:**	September 27, 2023
		Date Analyzed:	September 28, 2023
Analysis Requested:	Open Characterization	**No. of Samples:**	6
Instrument:	Thermal Desorption with Gas Chromatography Mass Spectrometry	**No. of Blanks:**	1
CASSEN Method:	M.2401	**Analyst:**	TL
Reference Method:	EPA TO-17/ISO 16017	**Reviewer:**	MB
Sampling Media:	AT-TUBE		
Sample Identification:	H0258026 (Field Blank)	**CASSEN ID:**	103361
		Date Sampled:	September 25, 2023
Sample Volume (L):	N.A. **GC/MS File: K06534.D**	**Date Analyzed:**	September 27, 2023

#	CAS Number	Tentative Identification	R.T. (min)	Amount (ng)	Conc. (µg/m³)
1	000526-73-8	Benzene, 1,2,3-trimethyl-	28.97	< 1	N.A.
2	000103-65-1	Benzene, propyl-	26.35	< 1	N.A.

*** A maximum of 5 compounds are reported for blanks.**

Total Volatile Organic Compounds		
	Total Amount (ng)	**Total Concentration (µg/m³)**
TVOCs	< 1	N.A.

See Final Page for Notes

CASSEN Testing Laboratories
51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Date: October 4, 2023

Organization:	exp. Services Inc.		
Address:	15701 Robin's Hill Road , London, Ontario, N5V 0A5		
Contact:	Ali Ismail	**Work Order No.:**	2513536
Project:	LON 23011333.AO	**Date Submitted:**	September 27, 2023
		Date Analyzed:	September 28, 2023

Notes:

N.A.: Not Available
1) Rank is based on the descending order of concentration.
2) CAS Number is the Chemical Abstracts Service registry number corresponding to the tentatively identified compound listed beside it. The tentative identification and its corresponding CAS Number were obtained as the best possible match from the results of the NIST Mass Spectral Library search.
3) Tentative Identification is based on the best match result of the mass spectral identification; results are not confirmed unless calibrated with reference standards.
4) Retention Time (R.T.) is the time that the VOC eluted from the column in the chromatogram.
5) Amount is the semi-quantitative estimate of the mass of the VOC in nanograms (ng) detected in the sampling media. The value depends on the VOC's response compared to selected reference compounds.
6) Conc. is the semi-quantitative estimate of the concentration of the VOC in micrograms per cubic meter (µg/m³) of air. The air volumes used are calculated based on the average of the pre- and post-flow rate and sampling time submitted to CASSEN Testing Laboratories.
7) TVOCs result (if applicable) is a semi-quantitative total amount/concentration based on the summation of the estimated masses of the VOC peaks in the chromatogram. The result depends on the response of each VOC compared to selected reference compounds.
8) Please note that this report is mostly focused on VOCs or compounds that are detectable using this method with a mass scanning range from 33 amu to 450 amu. Unstable/reactive compounds as well as those outside this range cannot be detected.
9) The sample(s) were received in acceptable condition unless otherwise noted.
10) CASSEN is an accredited laboratory in compliance with International Standard ISO/IEC 17025. A majority of our analyses are accredited which include methods from ISO, ASTM, EPA, NIOSH, OSHA, MDHS, USP. UNDOC, CDPH and in-house validated methods.
11) This test report pertains solely to the specific tests requested on the submitted samples and the conditions under which they were sampled. It is provided without any warranty, expressed or implied. CASSEN's liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. No responsibility or liability is assumed for the decisions or actions in which the results are used.

Summary of Results

Work Order No. 2513536 - exp. Services Inc.

Sample Name: 1175530 (Mt. Brydges A)

The total volatile organic compounds (TVOCs) concentration of this sample was found to be 4400 ug/m^3. The top three VOCs identified in this sample are:

1. Toluene with a concentration of 710 ug/m^3
2. Pentane with a concentration of 700 ug/m^3
3. Ethylene Glycol with a concentration of 510 ug/m^3

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
  [1-Hexanol, 2-ethyl-]
- **Aliphatic Hydrocarbons (Alkanes):**
  [Pentane], [Pentane, 2-methyl-], [n-Hexane], [Pentane, 2,2,4-trimethyl-], [Butane, 2-methyl-], [Pentane, 3-methyl-], [Pentane, 2,3-dimethyl-], [Pentane, 2,4-dimethyl-], [Pentane, 2,3,4-trimethyl-], [Hexane, 2-methyl-], [Hexane, 3-methyl-], [Pentane, 2,3,3-trimethyl-], [Heptane], [Butane, 2,3-dimethyl-], [Hexane, 2,3-dimethyl-], [Hexane, 2,4-dimethyl-], [Hexane, 2,5-dimethyl-], [Hexane, 2,2,4-trimethyl-]
- **Alkenes/ Conjugated Dienes:**
  [2-Butene]
- **Aromatic Hydrocarbons:**
  [Toluene], [m-Xylene + p-Xylene], [Benzene], [Ethylbenzene], [o-Xylene], [Benzene, 1,2,4-trimethyl-], [Benzene, 1-ethyl-3-methyl-]
- **Glycols/Glycol Ethers/acetates:**
  [Ethylene Glycol]
- **Ketones:**
  [2-Butanone (Methyl Ethyl Ketone)], [Methyl Isobutyl Ketone]
- **Light Hydrocarbon Gasses (C1 - C4):**
  [Butane]
- **Naphthenes (Cycloalkanes) and Benzo-Cycloalkanes:**
  [Cyclopentane, methyl-], [Cyclopentane], [Cyclohexane]
- **Sulphur-Containing Compounds:**
  [Benzothiazole]

Sample Name: 1024420 (Mt. Brydges O)

The total volatile organic compounds (TVOCs) concentration of this sample was found to be 1200 ug/m^3. The top three VOCs identified in this sample are:

1. 2-Butanone (Methyl Ethyl Ketone) with a concentration of 280 ug/m^3
2. Ethylene Glycol with a concentration of 210 ug/m^3
3. Acetic acid with a concentration of 120 ug/m^3

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
  [Ethanol], [1-Hexanol, 2-ethyl-], [1-Heptanol, 2-propyl-], [1-Nonanol]

- **Aldehydes:**
  [Hexanal], [Nonanal], [Decanal], [Octanal], [Benzaldehyde]

- **Aliphatic Hydrocarbons (Alkanes):**
  [Pentane], [Butane, 2-methyl-], [Pentane, 2-methyl-], [Pentane, 2,2,4-trimethyl-], [Hexane, 2-methyl-], [Pentane, 2,3-dimethyl-]

- **Aromatic Hydrocarbons:**
  [Toluene], [m-Xylene + p-Xylene]

- **Esters:**
  [Propanoic acid, methyl ester], [Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester], [2,2,4-Trimethyl-1,3-pentanediol diisobutyrate], [Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester]

- **Ethers:**
  [Dimethyl ether]

- **Fatty Acids:**
  [Heptanoic acid]

- **Glycols/Glycol Ethers/acetates:**
  [Ethylene Glycol]

- **Ketones:**
  [2-Butanone (Methyl Ethyl Ketone)], [Acetone], [Cyclohexanone]

- **Light Hydrocarbon Gasses (C1 - C4):**
  [Butane]

- **Naphthenes (Cycloalkanes) and Benzo-Cycloalkanes:**
  [Cyclohexane]

- **Organic Acids:**
  [Acetic acid], [Octanoic Acid]

- **Phenolics:**
  [Phenol]

- **Siloxanes/Silanes:**
  [Cyclopentasiloxane, decamethyl-], [Cyclotetrasiloxane, octamethyl-]

- **Sulphur-Containing Compounds:**
  [Benzothiazole]

Sample Name: 1024993 (Melbourne A)

The total volatile organic compounds (TVOCs) concentration of this sample was found to be 3000 ug/m^3. The top three VOCs identified in this sample are:

1. Pentane with a concentration of 460 ug/m^3
2. Ethylene Glycol with a concentration of 230 ug/m^3
3. Toluene with a concentration of 200 ug/m^3

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
  [Ethanol], [1-Hexanol, 2-ethyl-]

- **Aliphatic Hydrocarbons (Alkanes):**
  [Pentane], [Pentane, 2,2,4-trimethyl-], [Butane, 2-methyl-], [Pentane, 2-methyl-], [Pentane, 2,3,4-trimethyl-], [Pentane, 2,3-dimethyl-], [Pentane, 2,4-dimethyl-], [Pentane, 2,3,3-trimethyl-], [Pentane, 3-methyl-], [n-Hexane], [Butane, 2,3-dimethyl-], [Hexane, 2,3-dimethyl-], [Hexane, 2,5-dimethyl-], [Hexane, 2,4-dimethyl-], [Hexane, 2-methyl-], [Butane, 2,2-dimethyl-], [Hexane, 3-methyl-]

- **Alkenes/ Conjugated Dienes:**
  [2-Butene, 2-methyl-]

- **Aromatic Hydrocarbons:**
  [Toluene], [Benzene], [m-Xylene + p-Xylene], [Ethylbenzene], [o-Xylene], [Benzene, 1-ethyl-3-methyl-], [Benzene, 1,2,4-trimethyl-]

- **Glycols/Glycol Ethers/acetates:**
  [Ethylene Glycol]

- **Ketones:**
  [2-Butanone (Methyl Ethyl Ketone)], [Methyl Isobutyl Ketone], [Acetone]

- **Light Hydrocarbon Gasses (C1 - C4):**
  [Butane]

- **Naphthenes (Cycloalkanes) and Benzo-Cycloalkanes:**
  [Cyclopentane, methyl-], [Cyclohexane]

- **Sulphur-Containing Compounds:**
  [Benzothiazole]

Sample Name: B16865 (Melbourne O)

The total volatile organic compounds (TVOCs) concentration of this sample was found to be 260 ug/m^3. The top three VOCs identified in this sample are:

1. Pentane with a concentration of 28 ug/m^3
2. Ethanol with a concentration of 26 ug/m^3
3. Acetic acid with a concentration of 24 ug/m^3

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
  [Ethanol], [1-Hexanol, 2-ethyl-]

- **Aldehydes:**
  [Acetaldehyde], [Benzaldehyde]

- **Aliphatic Hydrocarbons (Alkanes):**
  [Pentane], [Butane, 2-methyl-], [Pentane, 2,2,4-trimethyl-], [Pentane, 2-methyl-], [Pentane, 2,3,4-trimethyl-], [Pentane, 2,3-dimethyl-], [Pentane, 2,4-dimethyl-], [Pentane, 3-methyl-], [Butane, 2,3-dimethyl-], [n-Hexane], [Butane, 2,2-dimethyl-], [Pentane, 2,3,3-trimethyl-], [Hexane, 2,5-dimethyl-]

- **Aromatic Hydrocarbons:**
  [Toluene], [Benzene], [m-Xylene + p-Xylene]

- **Chlorofluorocarbons:**
  [3-Chloro-2,3,3-trifluoroprop-1-ene], [Trichloromonofluoromethane]

- **Glycols/Glycol Ethers/acetates:**
  [Ethylene Glycol]

- **Halogenated Compounds:**
  [Carbon Tetrachloride]

- **Ketones:**
  [Acetone]

- **Light Hydrocarbon Gasses (C1 - C4):**
  [Butane]

- **Naphthenes (Cycloalkanes) and Benzo-Cycloalkanes:**
  [Cyclopentane], [Cyclohexane], [Cyclopentane, methyl-]

- **Organic Acids:**
  [Acetic acid], [Formic acid]

- **Siloxanes/Silanes:**
  [Cyclopentasiloxane, decamethyl-], [Cyclotetrasiloxane, octamethyl-]

- **Sulphur-Containing Compounds:**
  [Benzothiazole]

- **Terpenes/Terpenoids:**
  [.alpha.-Pinene]

Sample Name: 1024025 (Strathroy A)

The total volatile organic compounds (TVOCs) concentration of this sample was found to be 3600 ug/m^3. The top three VOCs identified in this sample are:

1. Ethylene Glycol with a concentration of 760 ug/m^3
2. Pentane with a concentration of 450 ug/m^3
3. Ethanol with a concentration of 250 ug/m^3

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
  [Ethanol], [Benzyl Alcohol]

- **Aliphatic Hydrocarbons (Alkanes):**
  [Pentane], [Pentane, 2,2,4-trimethyl-], [Butane, 2-methyl-], [Pentane, 2-methyl-], [Hexane, 2-methyl-], [n-Hexane], [Pentane, 2,3-dimethyl-], [Pentane, 2,3,4-trimethyl-], [Pentane, 3-methyl-], [Hexane, 3-methyl-], [Butane, 2,3-dimethyl-], [Pentane, 2,4-dimethyl-], [Pentane, 2,3,3-trimethyl-], [Heptane], [Hexane, 2,3-dimethyl-], [Butane, 2,2-dimethyl-]

- **Aromatic Hydrocarbons:**
  [Toluene], [m-Xylene + p-Xylene], [Benzene, 1-ethyl-3-methyl-], [Benzene, 1,2,4-trimethyl-], [Benzene, 1,3-diethyl-], [Ethylbenzene], [o-Xylene]

- **Glycols/Glycol Ethers/acetates:**
  [Ethylene Glycol]

- **Ketones:**
  [2-Butanone (Methyl Ethyl Ketone)], [Methyl Isobutyl Ketone]

- **Light Hydrocarbon Gasses (C1 - C4):**
  [Butane]

- **Naphthenes (Cycloalkanes) and Benzo-Cycloalkanes:**
  [Cyclopentane, methyl-], [Cyclohexane], [Naphthalene, decahydro-2-methyl-], [1H-Indene, 2,3-dihydro-1,3-dimethyl-]

- **Siloxanes/Silanes:**
  [Cyclopentasiloxane, decamethyl-]

- **Sulphur-Containing Compounds:**
  [Benzothiazole]

Sample Name: 1024767 (Strathroy O)

The total volatile organic compounds (TVOCs) concentration of this sample was found to be 2200 ug/m^3. The top three VOCs identified in this sample are:

1. Ethanol with a concentration of 550 ug/m^3
2. Pentane with a concentration of 220 ug/m^3
3. Ethylene Glycol with a concentration of 89 ug/m^3

The other major compounds found in this sample can be categorized into the following classes:

- **Alcohols:**
  [Ethanol]

- **Aldehydes:**
  [Hexanal]

- **Aliphatic Hydrocarbons (Alkanes):**
  [Pentane], [Pentane, 2,2,4-trimethyl-], [Hexane, 2-methyl-], [Butane, 2-methyl-], [Pentane, 2-methyl-], [Hexane, 3-methyl-], [Pentane, 2,3-dimethyl-], [n-Hexane], [Pentane, 2,3,4-trimethyl-], [Pentane, 3-methyl-], [Pentane, 2,4-dimethyl-], [Butane, 2,3-dimethyl-], [Pentane, 2,3,3-trimethyl-], [Heptane], [Tridecane], [Tetradecane], [Dodecane], [Butane, 2,2-dimethyl-], [Hexane, 2,3-dimethyl-]

- **Aromatic Hydrocarbons:**
  [Toluene], [m-Xylene + p-Xylene]

- **Chlorofluorocarbons:**
  [Ethane, 1-chloro-1,1-difluoro-]

- **Esters:**
  [2,2,4-Trimethyl-1,3-pentanediol diisobutyrate]

- **Glycols/Glycol Ethers/acetates:**
  [Ethylene Glycol]

- **Ketones:**
  [2-Butanone (Methyl Ethyl Ketone)], [Methyl Isobutyl Ketone]

- **Light Hydrocarbon Gasses (C1 - C4):**
  [Butane]

- **Naphthenes (Cycloalkanes) and Benzo-Cycloalkanes:**
  [Cyclopentane, methyl-], [Cyclohexane]

- **Organic Acids:**
  [Acetic acid]

- **Siloxanes/Silanes:**
  [Cyclopentasiloxane, decamethyl-]

- **Sulphur-Containing Compounds:**
  [Benzothiazole]

- **Terpenes/Terpenoids:**
  [D-Limonene]

Comments and Conclusions

As per client request, no interpretation is required.

Possible Relevant Sources

Common hydrocarbons without available threshold limit values (TLVs) are not listed. The conversion factor from mg/m^3 to ug/m^3 is 1000, i.e. 1 mg/m^3 = 1000 ug/m^3.

Alcohols

- **Ethanol**
  Sources: Ethanol is used extensively as a solvent in the manufacturing of varnishes, ink, cleaners, detergents, and paint. It is present in alcoholic drinks and used in perfumes, aftershave, and many personal care and pharmaceutical products. Ethanol is also used in disinfectants such as hand sanitizers and as a fuel and gasoline additive.
  TWA: N.A.
  STEL: 1000 ppm (1884.25 mg/m^3) (STEL = 1000 ppm)
  Odour: Sweet, alcoholic

- **Benzyl Alcohol**
  Sources: Benzyl alcohol is widely used in soaps, perfume, fragrances, and food additives. It is a useful solvent for ink, lacquer, coating, degreasing agent, dyeing polyamide, and paint stripper and can also be used as a bonding aid, a sealer for waterproofing the concrete.
  TWA: N.A.
  STEL: N.A.
  Odour: Pleasant, fruity

- **1-Hexanol, 2-ethyl-**
  Sources: It is used as a raw material for plasticizers and in the production of acrylates, surfactants, defoamers, and fuel and lube additives. It can be emitted from carpets, sheet vinyl flooring, photocopiers, and some plastics. It is also a naturally occurring plant volatile and can be found in a variety of fruits.
  TWA: 5 ppm (26.63 mg/m^3)
  STEL: N.A.
  Odour: Sweet, floral, characteristic

- **1-Nonanol**
  Sources: 1-Nonanol is used in the manufacturing of lemon oil, sprout suppression in commercial storage, and as a

flavour additive in food.
TWA: N.A.
STEL: N.A.
Odour: Rose-citrus odour

Aldehydes

- **Hexanal**
  Sources: Hexanal can be found from emissions of pressed wood products (hardwood plywood wall paneling, particle board, and fibreboard), furniture (composed of pressed wood), carpet, fabrics, adhesives, alkyd paint, and polyurethane wood finish.
  TWA: N.A.
  STEL: N.A.
  Odour: Pungent

- **Acetaldehyde**
  Sources: Sources of acetaldehyde include emissions from combustion processes such as vehicle emissions, boilers and process heaters, fireplaces and woodstoves, coffee roasting, and tobacco smoking. Acetaldehyde is a metabolic intermediate in humans and higher plants. The degradation of hydrocarbons, sewage, and solid biological wastes as well as the open burning and incineration of gas, fuel, oil, and coal produce acetaldehyde.
  TWA: N.A.
  STEL: 25 ppm (45.04 mg/m^3) (STEL = 25 ppm (Ceiling Limit))
  Odour: Pungent, fruity

- **Benzaldehyde**
  Sources: Benzaldehyde is used as a food additive, fragrance additive, and an industrial solvent for resins. It can be formed during burning/heating processes.
  TWA: N.A.
  STEL: 4 ppm (17.36 mg/m^3) (STEL = 4 ppm (OEL, MOL))
  Odour: Pleasant almond-like odour

- **Decanal**
  Sources: Decanal is used in fragrances and flavourings and is also found in indoor air originating from acoustical ceiling panels, carpets, and some resilient flooring materials.
  TWA: N.A.
  STEL: N.A.
  Odour: Buckwheat, citrus, fatty

- **Octanal**
  Sources: Octanal is used as a food additive in baked goods, candy, and gelatins. It is also found in perfumes and detergents and is the natural and major component of rose and citrus oils. Octanal is found in the emission of flooring and wood materials.
  TWA: N.A.
  STEL: N.A.
  Odour: Sharp, fatty, fruity odour

- **Nonanal**
  Sources: Nonanal is found in pressed wood products, adhesives, and resilient flooring materials, and may associate with formaldehyde-based adhesive used in these products.
  TWA: N.A.
  STEL: N.A.
  Odour: Fatty, waxy, floral

Aliphatic Hydrocarbons (Alkanes)

Common Sources: Aliphatic hydrocarbons are components of mixed solvent for varnishes, paint, paint removers, sheet vinyl flooring, coatings, printing inks, adhesives and degreasers. Aliphatic hydrocarbons are also ingredients of

petrochemical fuels, solvents and lubricants such as gasoline, mineral spirit, naphtha and motor oil etc. Emissions from combustion also generate many hydrocarbons especially those of lower molecular weight.

- **Butane, 2-methyl-**
  TWA: 1000 ppm (2950.92 mg/m³) (TWA = 1000 ppm (Pentane, all isomers))
  STEL: N.A.
  Odour: Mild gasoline

- **Pentane, 3-methyl-**
  TWA: 500 ppm (1762.37 mg/m³) (TWA = 500 ppm (Hexane isomers, other than n-Hexane))
  STEL: 1000 ppm (3524.74 mg/m³) (STEL= 1000 ppm (Hexane isomers, other than n-Hexane))
  Odour: N.A.

- **Pentane, 2-methyl-**
  TWA: 500 ppm (1760.94 mg/m³) (TWA = 500 ppm (Hexane isomers, other than n-Hexane))
  STEL: 1000 ppm (3521.88 mg/m³) (STEL = 1000 ppm (Hexane isomers, other than n-Hexane))
  Odour: Faint petroleum odour

- **Pentane**
  TWA: 1000 ppm (2950.92 mg/m³) (*TWA =1000 ppm (Pentane, all isomers))
  STEL: N.A.
  Odour: Gasoline-like

- **n-Hexane**
  TWA: 50 ppm (176.24 mg/m³)
  STEL: N.A.
  Odour: Gasoline

- **Dodecane**
  TWA: N.A.
  STEL: N.A.
  Odour: Gasoline-like

- **Heptane**
  TWA: 400 ppm (1639.26 mg/m³) (• TWA = 400 ppm (Heptane, all isomers))
  STEL: 500 ppm (2049.08 mg/m³) (• STEL = 500 ppm (Heptane, all isomers))
  Odour: Gasoline-like

- **Pentane, 2,2,4-trimethyl-**
  TWA: 300 ppm (1398.77 mg/m³) (TWA = 300 ppm (octane, all isomers))
  STEL: N.A.
  Odour: Gasoline

- **Pentane, 2,3-dimethyl-**
  TWA: 400 ppm (1639.26 mg/m³) (• TWA = 400 ppm (Heptane, all isomers))
  STEL: 500 ppm (2049.08 mg/m³) (• STEL = 500 ppm (Heptane, all isomers))
  Odour: Gasoline

- **Tridecane**
  TWA: N.A.
  STEL: N.A.
  Odour: N.A.

- **Tetradecane**
  TWA: N.A.
  STEL: N.A.
  Odour: N.A.

Alkenes/ Conjugated Dienes

- **2-Butene**
  Sources: 2-Butene is found in combustion products.
  TWA: 250 ppm (573.7 mg/m³) (TWA=250 ppm (Butenes, all isomers))
  STEL: N.A.
  Odour: Slightly aromatic

Aromatic Hydrocarbons

Common Sources: Aromatic hydrocarbons are used as solvents especially for paints, lacquers, coatings, gums, inks, adhesives, and resins. They are also used as raw material in the production of other materials, ingredients of petrochemical fuels, and emissions from burning, heating or combustion processes.

- **Benzene**
  TWA: 0.5 ppm (1.6 mg/m³)
  STEL: 2.5 ppm (7.99 mg/m³)
  Odour: Sweet, aromatic odour

- **o-Xylene**
  TWA: 20 ppm (86.84 mg/m³) (TWA = 20 ppm (Total Xylene, [m,p & o- isomers]))
  STEL: N.A.
  Odour: Aromatic

- **Benzene, 1,2,4-trimethyl-**
  TWA: 10 ppm (49.16 mg/m³) (TWA = 10 ppm (Trimethylbenzene, mixed isomers))
  STEL: N.A.
  Odour: Aromatic, pleasant

- **Ethylbenzene**
  TWA: 20 ppm (86.84 mg/m³)
  STEL: N.A.
  Odour: Aromatic, oily

- **m-Xylene + p-Xylene**
  TWA: 20 ppm (86.84 mg/m³) (TWA = 20 ppm (Total Xylene, [m,p & o- isomers]))
  STEL: N.A.
  Odour: Aromatic, sweet

- **Toluene**
  TWA: 20 ppm (75.37 mg/m³)
  STEL: N.A.
  Odour: Sweet, pungent

- **Benzene, 1,3-diethyl-**
  TWA: N.A.
  STEL: N.A.
  Odour: Aromatic

Chlorofluorocarbons

- **Ethane, 1-chloro-1,1-difluoro-**
  Sources: Also known as HCFC-142b, or R-142b, it is rarely used by itself; is generally a component of a refrigerant blend known as R-409A, which includes HCFC-22. HCFC-142b is also used for foam blowing and as a propellant in aerosol cans.
  TWA: N.A.

STEL: N.A.
Odour: Ethereal

- **Trichloromonofluoromethane**
  Sources: Also known as Freon-11, it was used extensively in the past but as a result of its potential in ozone depletion, many of its uses have become increasingly restricted or banned; however, the use of existing stocks is still permitted. Its major uses include coolants/refrigerants, blowing agent, degreasing agent, solvent, fire extinguishing agent, and aerosol propellant.
  TWA: N.A.
  STEL: 1000 ppm (5618.81 mg/m³) (STEL = 1000 ppm (Ceiling Limit))
  Odour: Slightly Ethereal

Esters

- **Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester**
  Sources: Component of Texanol
  TWA: N.A.
  STEL: N.A.

- **Propanoic acid, methyl ester**
  Sources: It is used as a solvent in paints, lacquers, varnishes and coatings, and is also a natural component in some fruits.
  TWA: N.A.
  STEL: N.A.
  Odour: Fruity odour (pineapple)

- **2,2,4-Trimethyl-1,3-pentanediol diisobutyrate**
  Sources: It is used as an additive in plastic (plasticizer) and as the coalescent agent for latex paints. It is also used as a retarder solvent in coil coatings and high-bake enamels, as wood preservative carriers, floor polishes and as solvent for nail polish, cosmetics, and personal care products.
  TWA: N.A.
  STEL: N.A.
  Odour: Unpleasant, musty

Ethers

- **Dimethyl ether**
  Sources: Dimethyl ether is used as solvent, aerosol propellant, refrigerant, fuel, rocket propellant, anesthetic, and starter for gasoline engines in cold weather.
  TWA: N.A.
  STEL: N.A.
  Odour: Ethereal odour

Fatty Acids

- **Heptanoic acid**
  Sources: Released from flooring materials, additive to cigarettes, and used in organic synthesis
  TWA: N.A.
  STEL: N.A.
  Odour: rancid

Glycols/Glycol Ethers/acetates

- **Ethylene Glycol**
  Sources: It is a clear, odorless, slightly viscous liquid with a sweet taste. It is produced commercially in large amounts and widely used as an antifreeze and de-icer. It can be found in many consumer products, including latex paints, hydraulic brake fluids, inks used in some stamp pads, ballpoint pens, solvents, plastics, and solar energy systems.
  TWA: 25 ppm (63.47 mg/m³) (TWA = 25 ppm (Vapor and aerosol))
  STEL: 50 ppm (126.93 mg/m³) (STEL = 50 ppm (Vapor and aerosol) (STEL = 10 mg/m³ Inhalable Particulate Matter and Aersol only))
  Odour: Sweet

Halogenated Compounds

- **Carbon Tetrachloride**
  Sources: Carbon tetrachloride is used in the production of refrigeration fluid and propellants for aerosol cans, as a pesticide, cleaning fluid and degreasing agent, solvent for varnishes and wood stains, and in fire extinguishers and spot removers.
  TWA: 5 ppm (31.46 mg/m³)
  STEL: 10 ppm (62.92 mg/m³)
  Odour: Sweet, chloroform, dry cleaner

Ketones

- **Acetone**
  Sources: Acetone occurs in the nature as well as a man-made compound. It is used to produce other chemicals and as a solvent for surface coatings, inks, resins, varnishes, lacquers, carpet adhesive, thinners, cleaners, and automotive care products. It is formed in combustion processes. It occurs naturally in plants, trees, volcanic gases, forest fires, and as a product of the breakdown of body fat. It is present in exhaled breath, vehicle exhaust, tobacco smoke, and landfill sites. In indoor air, exhaled breath is a key contributor of acetone.
  TWA: 250 ppm (593.87 mg/m³)
  STEL: 500 ppm (1187.73 mg/m³)
  Odour: Minty chemical, sweet

- **2-Butanone (Methyl Ethyl Ketone)**
  Sources: Also known as methyl ethyl ketone, it is used as a solvent for lacquers, adhesives, and protective coatings. It is also a common ingredient in consumer products such as varnishes, glues, printing inks, paints, woodstains, and paint removers.
  TWA: 200 ppm (589.78 mg/m³)
  STEL: 300 ppm (884.66 mg/m³)
  Odour: Sweet, acetone-like

- **Methyl Isobutyl Ketone**
  Sources: Methyl isobutyl ketone is used as a solvent in lacquers and varnishes, and as a minor component of paint solvents, including car and industrial spray paints. It is used in the semiconductor industry as a hard surface cleaner, synthetic flavouring adjuvant, and fragrance additive.
  TWA: 20 ppm (81.93 mg/m³)
  STEL: 75 ppm (307.24 mg/m³)
  Odour: Sweet, sharp and camphor-like odour

- **Cyclohexanone**
  Sources: Cyclohexanone is a synthetic organic liquid used primarily as an intermediate in the production of nylon. Other minor applications are as an intermediate, additive, and solvent in a variety of products. It is found in aerosol paint concentrates, wood office work, insecticides, fungicides, markers, synthetic resin, and rubber adhesives.
  TWA: 20 ppm (80.28 mg/m³)
  STEL: 50 ppm (200.71 mg/m³)

Odour: Sweet, pepperminty, sharp

Light Hydrocarbon Gasses (C1 - C4)

- **Butane**
  Sources: Butane is used as a producer gas and in the manufacturing of synthetic rubbers. It is also used as an aerosol propellant, fuel, and chemical intermediate and is present in natural gas and liquefied petroleum gas as well as in combustion products.
  TWA: N.A.
  STEL: 1000 ppm (2377.1 mg/m³) (**STEL = 1000 ppm (Butane, isomers))
  Odour: Gasoline, natural gas

Naphthenes (Cycloalkanes) and Benzo-Cycloalkanes

- **Cyclopentane, methyl-**
  Sources: Methylcyclopentane is used in organic synthesis and as an extractive solvent, azeotropic distillation agent, component of mixed hydrocarbons solvent, and is a combustion product.
  TWA: N.A.
  STEL: N.A.
  Odour: Sweet, gasoline

- **Cyclohexane**
  Sources: Cyclohexane is used in the production of nylon fibre and nylon molding resins, as a solvent for paint, resins, varnish and oils, plasticizers, and as an intermediate in the manufacturing of other industrial chemicals. It is also used in many applications including paint, polish and cleaners, sealants, lubricating oil, varnish removers, synthetic resin and rubber adhesives, and liquid toilet soap.
  TWA: 100 ppm (344.21 mg/m³)
  STEL: N.A.
  Odour: Pungent, solvent, oil

- **Cyclopentane**
  Sources: Cyclopentane is commonly used for cracking aromatics. Commercially, it is used to produce a variety of analgesics, sedatives, hypnotics, antitumor agents, CNS depressants, prostaglandins, insecticides, and many other products. Cyclopentane is also used as a laboratory reagent, solvent in paint, and in shoe manufacturing and wax extraction.
  TWA: 1000 ppm (2868.3 mg/m³) (TWA =1000 ppm (Explosion hazard: the substance is a flammable asphyxiant or excursions above the TLV could approach 10% of the lower explosive limit.))
  STEL: N.A.
  Odour: Mild, sweet

Organic Acids

- **Formic acid**
  Sources: The main industrial applications for formic acid include coagulant for rubber latex, nickel plating baths, production of wire-stripping compounds needed for soldering bare wire, and dyeing and finishing of textile, paper, and treatment of leather. Formic acid is also used in household products such as liquid hand soaps, body wash lotions, toilet bowl cleaners, and multi-surface cleaners.
  TWA: 5 ppm (9.41 mg/m³)
  STEL: 10 ppm (18.82 mg/m³)
  Odour: Pungent, penetrating

- **Acetic acid**
  Sources: Acetic acid is found in the atmosphere, ocean water, and rain and formed in the air by reaction of hydrocarbons with ozone. It is formed in the air by reaction of hydrocarbons with ozone. Acetic acid is widely used to make other chemicals such as manufacturing of vinyl acetate monomer, which in turn is used to produce base

resins for water-based paints, hot melt adhesives, paper coatings, and textile finishes. It is found in caulks and sealants, wood products, rubber, and food additives. Acetic acid has also been found in adhesives used in archival boxes. In consumer products, it is used in glass window cleaning preparations, household detergents and surface cleaners, laundry aids, disinfectants, polishes, and varnish removers. Other sources of acetic acid include burning heating and combustion processes. It is also found to be an oxidation product of coal.
TWA: 10 ppm (24.54 mg/m³)
STEL: 15 ppm (36.81 mg/m³)
Odour: Sour, vinegar-like

Phenolics

- **Phenol**
  Sources: Phenol is a common industrial chemical that is used in the manufacturing of resins, plastics, fibers, adhesives, some metals, leather, and rubber. Phenol is used in a variety of consumer products including disinfectants, medicinal preparations (i.e. mouth washes, throat lozenges, and antiseptic lotions), and as a biocide in paints. It is also found in construction material such as phenol formaldehyde resins, as well as cigarette smoke, motor vehicle emissions and combustion products.
  TWA: 5 ppm (19.25 mg/m³)
  STEL: N.A.
  Odour: Medicinal, sweet

Siloxanes/Silanes

- **Cyclopentasiloxane, decamethyl-**
  Sources: Decamethylcyclopentasiloxane is used in personal care products such as lotion, cosmetics, and hair spray. It is also used in sealant materials, carpet, ceiling tiles, floor and furniture polish, lubricants, silicone adhesive, and elastomers in ceiling light gaskets and as a dry cleaning solvent replacing perchloroethylene. It is often found with ethanol when used in personal care products or with limonene if used with cleaning or polishing products.
  TWA: N.A.
  STEL: N.A.
  Odour: Mild

- **Cyclotetrasiloxane, octamethyl-**
  Sources: Octamethylcyclotetrasiloxane is used in cleaning agents, dyes, fillers, polishes, lubricants, and adhesives.
  TWA: N.A.
  STEL: N.A.
  Odour: N.A.

Sulphur-Containing Compounds

- **Benzothiazole**
  Sources: Benzothiazole is a common compound used in producing rubber products such as rubber backing of flooring materials and rubber and is also used as an antifungal agent in shoe insoles.
  TWA: N.A.
  STEL: N.A.
  Odour: Unpleasant rubber odour

Terpenes/Terpenoids

- **.alpha.-Pinene**
  Sources: Alpha-pinene is found in wood and engineering wood such as fibreboard, gypsum board, chipboard, and plywood. Other sources include adhesives, insecticides, solvents, plasticizers, cleaners and detergents, scented products, and synthetic pine oil.

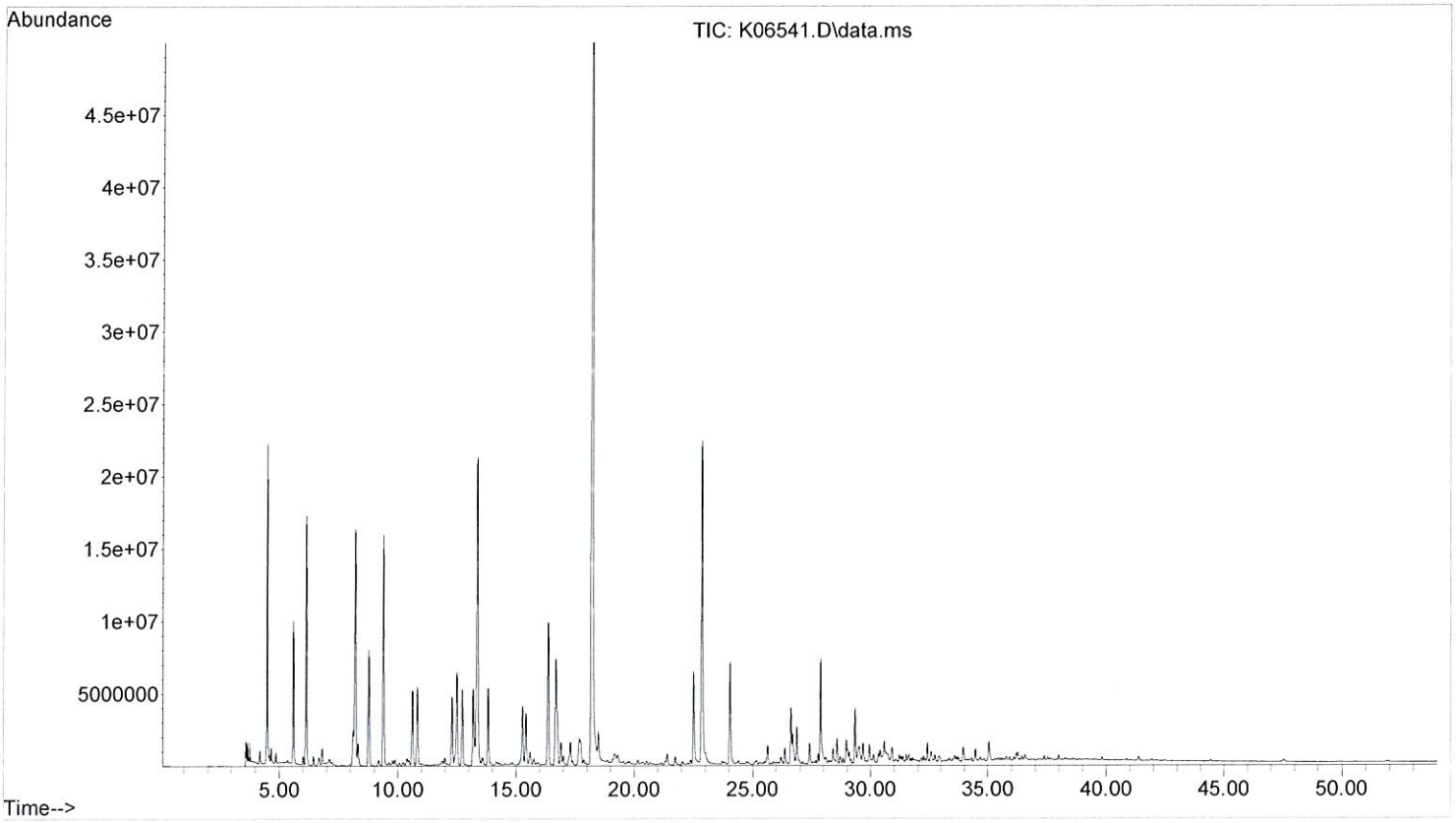
TWA: 20 ppm (111.44 mg/m³) (TWA=20 ppm [Turpentine and selected monoterpenes])
STEL: N.A.
Odour: Pine, turpentine-like odour

- **D-Limonene**
  Sources: D-limonene is found in wood and engineering wood products, furniture polishes, detergents, air fresheners, cleaners, essential oils, chipboard, resins, building products, and furnishings. It is also used as an additive in consumer products to provide a lemon or citrus fragrance.
  TWA: N.A.
  STEL: N.A.
  Odour: Lemon, citrus

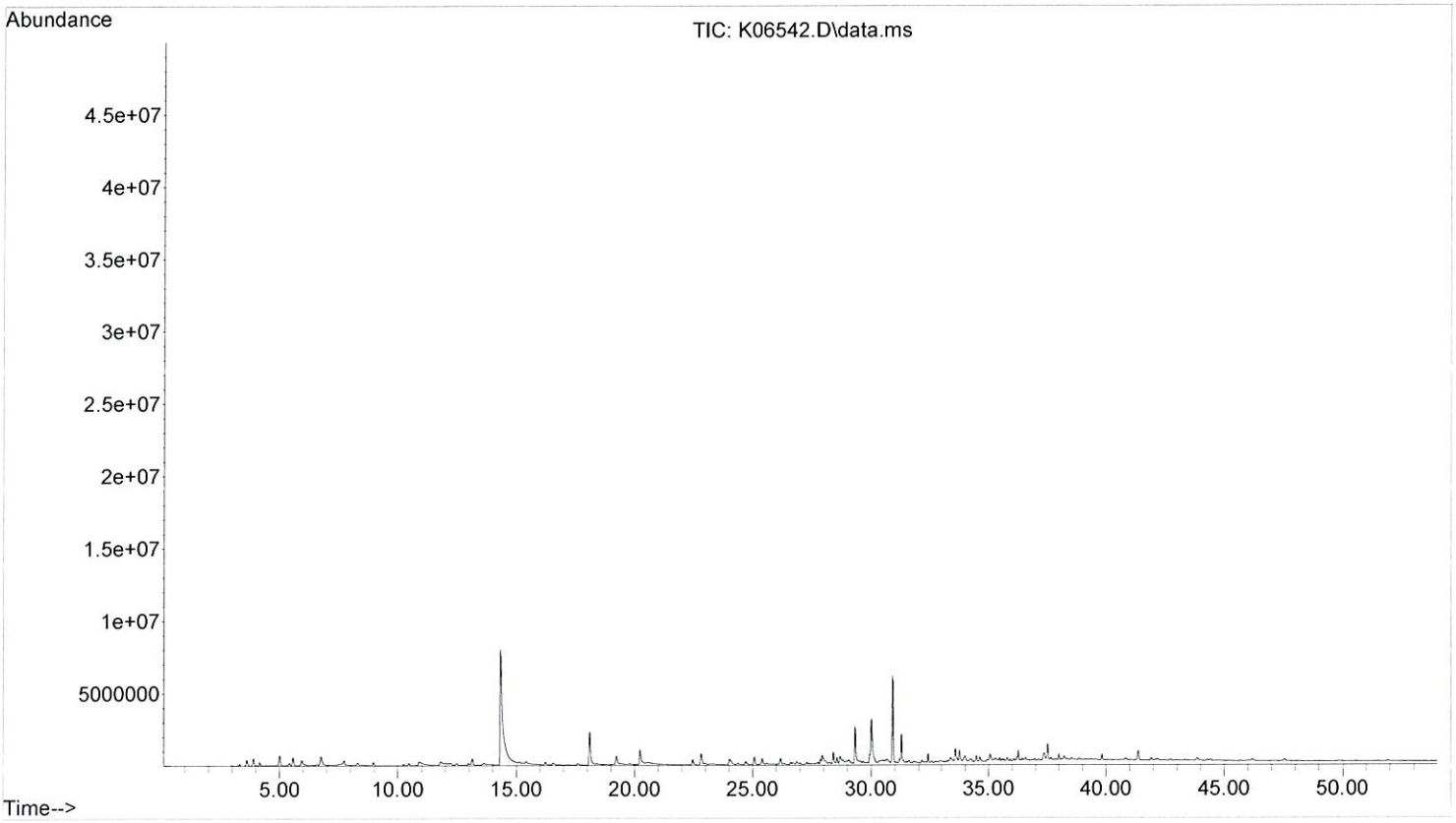
Notes:

This report summarizes the results of the open characterization analysis of volatile organic compounds (VOCs) in indoor or workplace air and their respective semi-quantitative concentrations. Although up to 350 compounds can be detected in a complex environment, only a maximum of top 35 compounds is reported and categorized in this report. Since there are many difference sources for each compound, and additional usages are added constantly, the relevant sources provided in this report are for general information and should be used with discretion. Site inspection and investigation will provide more comprehensive information on the likely sources of the VOCs found. Please note that this report is strictly focused on the volatile organic compounds that can be detected using this method. Unstable/reactive compounds as well as those outside VOC range would not be detected.

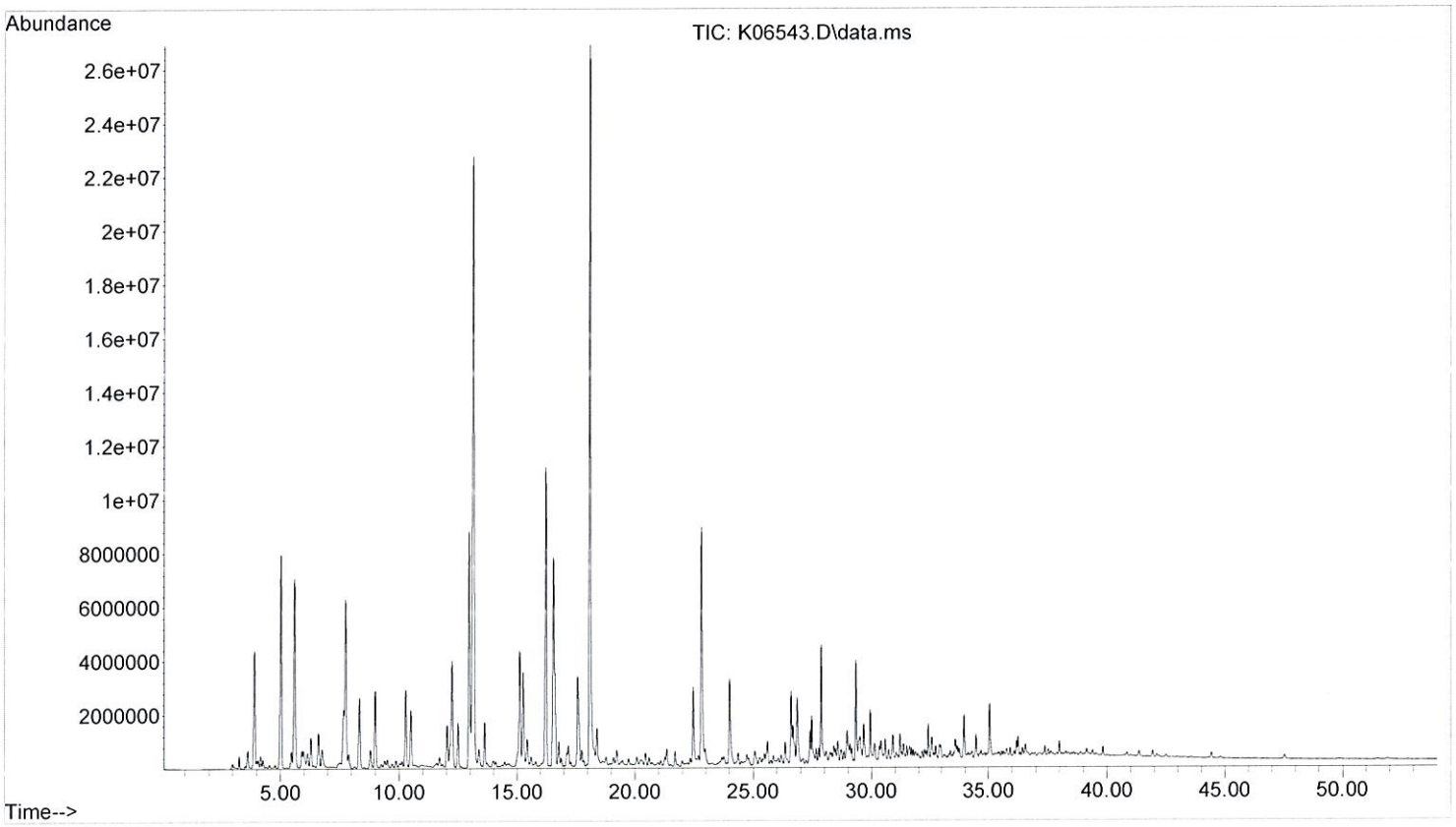
File :Y:\GCData\GC-MS-2\K06541.D
Operator : CK
Acquired : 28 Sep 2023 8:02 using AcqMethod TVOCSC4.M
Instrument : GCMS2
Sample Name: 103355-EXP-1175530
Misc Info : Checked by TL
Vial Number: 45



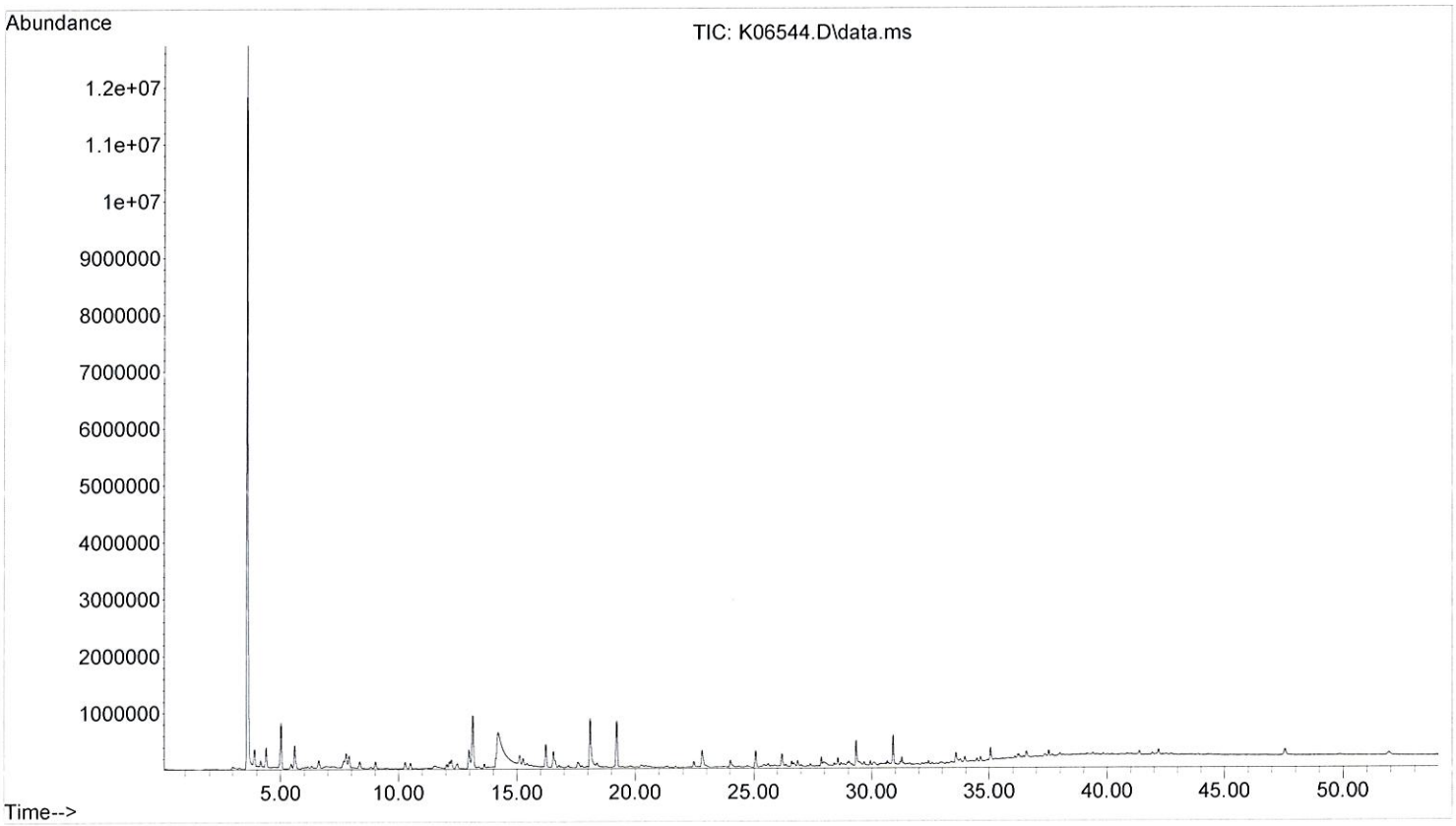
File :Y:\GCData\GC-MS-2\K06542.D
Operator : CK
Acquired : 28 Sep 2023 9:24 using AcqMethod TVOCSC4.M
Instrument : GCMS2
Sample Name: 103356-EXP-1024420
Misc Info : Checked by TL and CK
Vial Number: 46



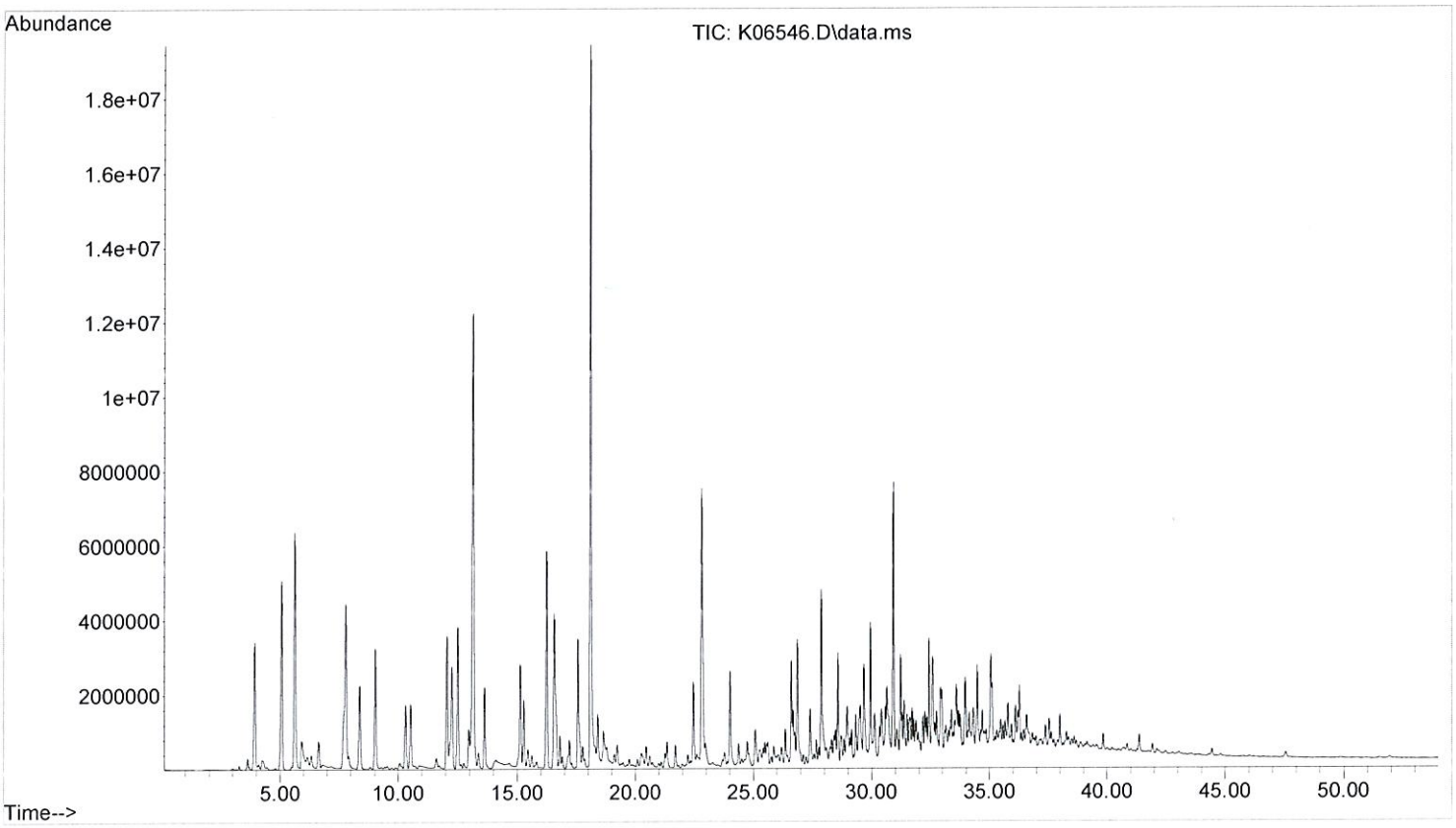
File :Y:\GCData\GC-MS-2\K06543.D
Operator : CK
Acquired : 28 Sep 2023 10:47 using AcqMethod TVOCSC4.M
Instrument : GCMS2
Sample Name: 103357-EXP-1024993
Misc Info : Checked by TL and CK
Vial Number: 47



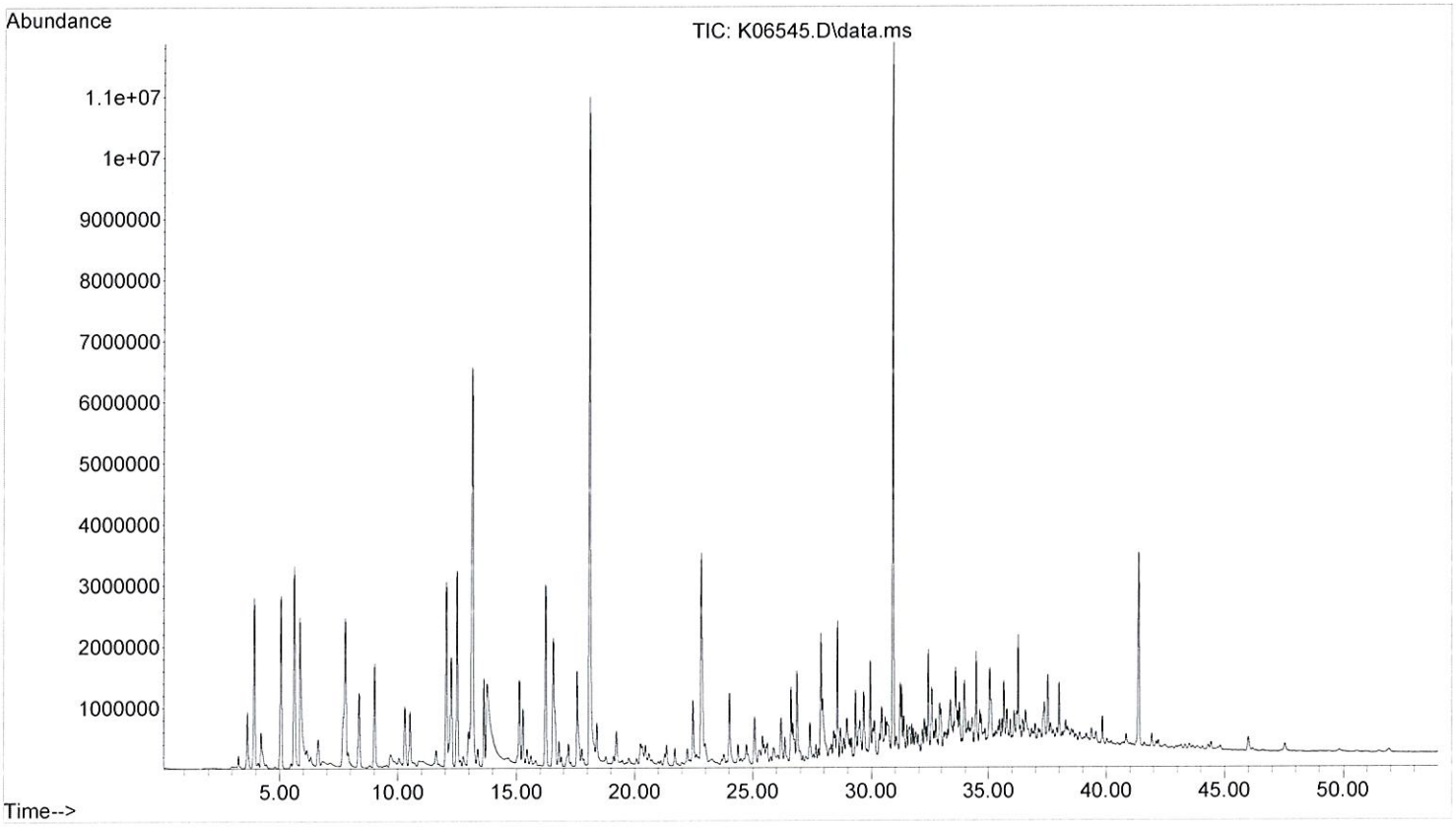
File :Y:\GCData\GC-MS-2\K06544.D
Operator : CK
Acquired : 28 Sep 2023 12:13 using AcqMethod TVOCSC4.M
Instrument : GCMS2
Sample Name: 103358-EXP-B16865
Misc Info : Checked by TL and CK
Vial Number: 48



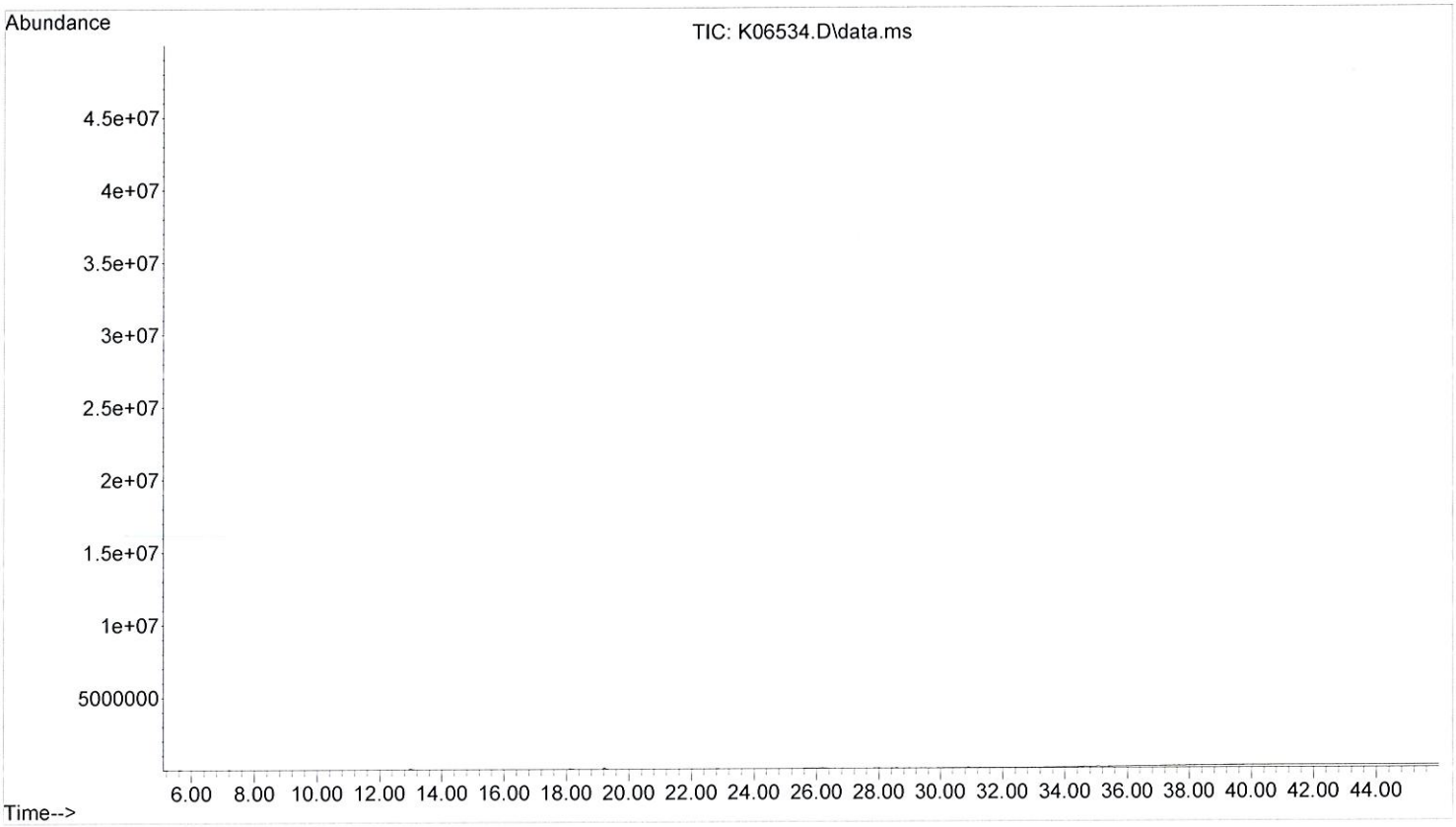
File :Y:\GCData\GC-MS-2\K06546.D
Operator : CK
Acquired : 28 Sep 2023 14:59 using AcqMethod TVOCSC4.M
Instrument : GCMS2
Sample Name: 103359-EXP-1024025
Misc Info : Checked by TL and MB
Vial Number: 50



File :Y:\GCData\GC-MS-2\K06545.D
Operator : CK
Acquired : 28 Sep 2023 13:36 using AcqMethod TVOCSC4.M
Instrument : GCMS2
Sample Name: 103360-EXP-1024767
Misc Info : Checked by TL and MB
Vial Number: 49



File :Y:\GCData\GC-MS-2\K06534.D
Operator : CK
Acquired : 27 Sep 2023 19:19 using AcqMethod SC4STD_43.M
Instrument : GCMS2
Sample Name: 103361-EXP-H0258026 FB
Misc Info :
Vial Number: 42



CASSEN Testing Laboratories
Environmental Health Solutions

Pump Flow Rate Sheet

Client: exp. **Units:** 50mL/min
Contact: Ali Ismail
Work Order: 2513536

Pre-Sampling Flow Rate

Initials: KC **Date:** 08/09/2023

Calibrator Media:	AT 1024393 Calibration	
Calibrator:	BIOS Defender 520Low Flow	
Pump ID#	GA302013	
Set Flow	50mL/min	
#1	50.439	
#2	50.422	
#3	50.396	
#4	50.372	
#5	50.514	
#6	50.672	
#7	50.588	
#8	50.501	
Average	50.488	

Post-Sampling Flow Rate*

Initials: KC **Date:** 27/09/2023

Calibrator Media:	AT 1024393 Calibration	
Calibrator:	BIOS Defender 520Low Flow	
Pump ID#	GA302013	
Set Flow	50mL/min	
#1	50.823	
#2	50.732	
#3	50.652	
#4	50.892	
#5	50.850	
#6	50.790	
#7	50.715	
#8	50.668	
Average	50.765	

Pre/Post Combined Average

Pump ID#	GA302013	
Average	50.627	

*Volumes may change after Post-Sampling Flow Rate reading

Prepared by: Kathleen Calvo

CASSEN Testing Laboratories
Environmental Health Solutions

Pump Flow Rate Sheet

Client: exp
Contact: Ali Ismail
Work Order: 2513536

Units: 50mL/min

Pre-Sampling Flow Rate

Initials: KC **Date:** 08/09/2023

Calibrator Media:	AT Tube 1024393				
Calibrator:	BIOS Defender 520				
Pump ID#	GA302017	GA302030	GA302022	GA302015	GA302032
Set Flow	50mL/min	50mL/min	50mL/min	50mL/min	50mL/min
#1	50.437	50.025	50.781	50.807	50.694
#2	50.660	50.200	50.409	50.800	50.473
#3	50.583	50.210	50.369	50.693	50.490
#4	50.635	50.174	50.498	50.949	50.426
#5	50.595	49.965	50.293	50.770	50.356
#6	50.478	50.062	50.082	50.655	50.168
#7	50.406	50.068	50.056	50.855	50.167
#8	50.536	50.090	49.813	50.839	50.167
Average	50.541	50.099	50.288	50.796	50.368

Post-Sampling Flow Rate*

Initials: KC **Date:** 27/09/2023

Calibrator Media:	AT Tube 1024393				
Calibrator:	BIOS Defender 520				
Pump ID#	GA302017	GA302030	GA302022	GA302015	GA302032
Set Flow	50mL/min	50mL/min	50mL/min	50mL/min	50mL/min
#1	49.677	49.780	50.594	50.625	50.254
#2	49.880	49.750	50.386	50.825	50.088
#3	49.973	49.746	50.179	50.737	50.082
#4	49.803	49.536	50.004	50.628	49.975
#5	49.887	49.638	49.544	50.713	49.889
#6	49.475	49.751	49.248	50.780	49.672
#7	49.515	49.750	49.273	50.496	49.412
#8	49.584	49.651	49.080	50.662	49.292
Average	49.724	49.700	49.789	50.683	49.833

Pre/Post Combined Average

Pump ID#	GA302017	GA302030	GA302022	GA302015	GA302032
Average	50.133	49.900	50.038	50.740	50.100

*Volumes may change after Post-Sampling Flow Rate reading

Prepared by: Kathleen Calvo

CASSEN Testing Laboratories

ANALYTICAL SERVICES REQUEST FORM

Division of CASSEN Group Inc.

51 International Blvd.
Toronto, ON M9W 6H3
Tel: (416) 679-9663
Fax: (416) 679-9668
Toll Free: 1-866-423-3001
Web: www.cassen.ca

FOR CASSEN USE ONLY
CASSEN Work Order No: 2513536

Send Report To: ☐ Check if this is a new address				**Invoice To (if different):** ☐ Check if this is a new address			
Company:	EXP Services Inc.			Company:			
Address:	15701 Robin's Hill Rd.			Address:			
City:	London	Province:	ON	City:		Province:	
Attention:	Ali Ismail	Postal Code:	N5V 0A5	Attention:		Postal Code:	
Phone:	519-280-0184	Fax:		Phone:		Fax:	
Email:	ali.ismail@exp.com			Email:			

Required Turnaround Time

☒ Regular Routine Analysis Turnaround Time (5 Days)* ○ Open Characterization with Interpretation Requires 10 Days* TAT

Rush Analysis Options (Please Call Ahead)

○ 8 Hours ○ 24 Hours ○ 48 Hours ○ 72 Hours

Project Name / Number: LON-23011333-A0 Sampled By: Ali Ismail P.O. Number: LON-23011333-A0 ☒ Sampling Data Sheet Attached

Client Sample Number Description/Identification	Date Sampled (DD/MM/YYYY)	Sample Type	Active Sample Volume (L)	Passive Sample Time (mins)	Analysis Requested	Comment	LAB ID (For lab use)
1175530 (Mt. Brydges A)	25/09/2023	TD Tube	11.531		Open Characterization - VOCs	EPA Method TO-17	103355
1024420 (Mt. Brydges O)	↓	↓	11.467		↓	↓	103356
1024993 (Melbourne A)			11.058				103357
B16865 (Melbourne O)			11.138				103358
1024025 (Strathroy A)			11.028				103359
1024767 (Strathroy O)			11.022				103360
H0258026 (FB)	↓	↓	—		↓	↓	103361

Special Instructions: pre and post calibrations done by CASSEN

CHAIN OF CUSTODY	Print Name	Signature	Date (DD/MM/YYYY)	Time
Relinquished by:	Ali Ismail		25/09/2023	17:00
Received by Lab:			27/09/2023	9:00 am

Sample Condition Upon Receipt

☒ Acceptable
☐ Other (Explain Below)

Sample Condition Additional Comments:

volumes calculated as per sample minutes & avg. pre-/post-calibration flow rates

27/9/23

* Working days only, please consult the laboratory regarding workload. Samples received after 3:00PM will be treated as next day's sar
CASSEN's terms and conditions form a part of this contract for services. (See forms section of our website)